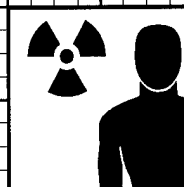
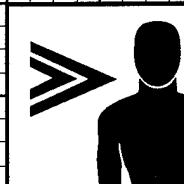
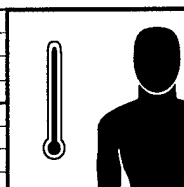


UNITED STATES ARMY
HEALTH HAZARD ASSESSMENT MANUAL
Procedures Guide October 1994

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U.S. ARMY HEALTH HAZARD ASSESSMENT MANUAL: Procedures Guide

OCTOBER 1994

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Preface

This is the first U.S. Army Health Hazard Assessment (HHA) Manual. We intend to provide page updates annually, thus the three-ring binder format. This manual is an effort to provide assistance to assessors, combat developers (CBTDEVs), and materiel developers (MATDEVs) in addressing health hazards during the acquisition process. With your feedback, we can continually improve this document to aid you in addressing health hazards.

We encourage you to submit recommended changes and comments to improve the publication. Key comments to the page, paragraph, and line of text in which the change is recommended. Provide reasons for each comment to ensure understanding and complete evaluation. Prepare comments using Department of the Army (DA) Form 2028 (Recommended Changes to Publications and Blank Forms) and forward to:

Commander
U.S. Army Center for Health Promotion and Preventive Medicine/
U.S. Army Environmental Hygiene Agency
ATTN: MCHB-MO-A
Aberdeen Proving Ground, MD 21010-5422

■ *NOTE: The U.S. Army Environmental Hygiene Agency (AEHA) was provisionally redesignated the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) on 1 August 1994.*

Executive Summary

The HHA process identifies, assesses, and eliminates or controls health hazards associated with the life cycle management (LCM) of:

- Weapons systems.
- Munitions.
- Equipment.
- Clothing.
- Training devices.
- Materiel/information systems.

Early identification and evaluation of health hazards is essential to:

- Preserve and protect the health of the soldier.
- Reduce soldier performance decrement and enhance system effectiveness.
- Reduce system retrofits required to reduce, control, or eliminate health hazards.
- Enhance readiness.
- Reduce personnel compensation.
- Reduce environmental contamination associated with the life cycle production and use of Army systems.

Historically, the key players in the HHA process have been:

- Office of The Surgeon General (OTSG).
- CBTDEVs.
- MATDEVs.
- U.S. Army Environmental Hygiene Agency (CHPPM/AEHA).
- U.S. Army Materiel Command (AMC) Surgeon.
- U.S. Army Training and Doctrine Command (TRADOC) Surgeon.
- U.S. Army Test and Evaluation Command.
- U.S. Army Medical Research Materiel Command (MRMC) and its laboratories.
- Army Medical Department Center and School (AMEDDC&S).

- U.S. Army Safety Center.

The medical assets within these key players have had a tremendous challenge in providing adequate HHA support to the CBTDEVs (17 service schools/integrating centers), TRADOC system managers (26), program/project/product managers (207), and program executive officers (PEOs) (12).

Prior to 1991, the efforts to establish the health hazard assessment program (HHAP) were focused on:

- Attaining initial resources (13 people).
- Learning the acquisition system.
- Establishing relationships with the key players.
- Building initial credibility.
- Focusing HHA action on one “system” at a time.

The HHAP has been effective but must expand to keep pace with increased demand. The Army Medical Department (AMEDD) has program requirements for more dedicated resources and the need to:

- Establish better methods for early identification and elimination of health hazards in systems.
- Build better linkages between the medical research and development efforts and system development.
- Integrate pollution prevention into system development.
- Integrate soldier survivability—a new manpower and personnel integration (MANPRINT) domain.

These requirements will be difficult to meet in the face of downsizing, Army reorganizations, and an increase in the number of “systems” requiring analysis of health hazards.

The HHA community is developing a comprehensive strategy that builds upon past accomplishments and provides a framework for the Army to meet the growing health hazard challenges we face as we enter the next century. A formal strategy—focusing on prevention, protection, performance, and sustainment—will provide a mechanism for identifying new opportunities and defining ways to meet this

responsibility as part of our mission to maintain a trained and ready Army. This manual is part of the strategy and:

- Provides an orientation to the U.S. Army's HHAP for systems acquisition.
- Is intended primarily for:
 - Independent medical assessors.
 - CBTDEVs, MATDEVs, and system MANPRINT practitioners.
 - Other independent assessors.
- Focuses on practical information in the context of the Army's materiel acquisition process (life cycle system management).
- Is a resource for individuals striving to eliminate or control health hazards in Army systems.

The Vision

“The U.S. Army will be the national leader in eliminating health hazards from, and integrating human performance criteria into the life-cycle management of materiel systems.”

The primary objective of the HHAP is to identify and eliminate or control health hazards associated with the LCM of weapons, equipment, clothing, training devices, materiel, and information systems.

The Army's health hazard activities are linked inextricably with its military combat doctrine and integration of Army capabilities. The HHAP supports the four elements of combat power: maneuver, firepower, protection, and leadership. It also supports the entire breadth and diversity of the Army technology base.

Health hazard issues, if not managed effectively, can consume funds needed elsewhere and hinder training and mobilization. There will be faster, longer range, and higher technology weapons in the future. Training with this equipment will create the potential for increased adverse health hazard exposures, a decrease in soldier survivability, and an increase in environmental contamination. Proper health hazard management is critical to protect Army resources and to ensure high quality and realistic training.

Health hazard leadership is a key ingredient for the Army of the future to be successful. It can be achieved only if health hazard and human performance concerns are integrated into Army decision making and activities. Army research, development, acquisition, operations, maintenance, demilitarization, and disposal strategies will include these concerns from the outset so that health hazard and human performance issues are identified and resolved in a timely fashion. This management will enhance the Army's transition to a smaller force with a quick response capability.

The HHAP is an integrated effort throughout the materiel acquisition process that considers:

- Mission needs.
- Concept analysis.
- Research.
- Development.
- Testing.

- Evaluation.
- Production.
- Procurement.
- Training.
- Use.
- Storage.
- System maintenance.
- Transportation.
- Demilitarization.
- Disposal.

Specific objectives of the HHAP are to:

- Preserve and protect the health of the individual soldier.
- Reduce degradation of the soldier's performance and of the system's effectiveness.
- Enhance the original system design so that retrofits needed to eliminate or control health hazards are reduced.
- Reduce readiness deficiencies that are attributable to health hazards, which cause training or operational restrictions.
- Reduce personnel compensation claims by eliminating or reducing injury or illness caused by health hazards associated with the use of Army systems.
- Reduce health hazards that may impact on soldier survivability.
- Reduce health hazards due to potential environmental contamination associated with the use of Army systems.

Historically, HHA has been considered the responsibility of the AMEDD. While the expertise in addressing health hazards may in fact be in the AMEDD, the responsibility for health hazard reduction lies with all personnel involved with system acquisition including logisticians, acquisition managers, CBTDEVs, and MATDEVs. This is a "team" effort. If the team does not consider health hazards, other MAN-PRINT domain areas (manpower, personnel, training, systems safety, human factors engineering (HFE), and survivability), and pollution prevention as military systems

are conceived and developed, then substandard products may be produced. Such oversight will have an adverse effect on our military capability. The impact will be failure to meet those specific objectives listed above.

In the past, HHA often has been considered an administrative requirement—an item to check off on a checklist of requirements to get through a milestone decision review. The consideration of health hazards is not, nor has it ever been, an administrative requirement. Health hazards that are not considered and eliminated or controlled will impact on the one resource we cannot afford to sacrifice: the soldier.

System LCM is a cradle-to-grave concept. While not always practiced, today this concept must be followed. The life cycle of a materiel system consists of:

- Preconcept activities.
- Concept exploration and definition.
- Demonstration and validation.
- Engineering and manufacturing development.
- Production and deployment.
- Operation and maintenance.
- Demilitarization.
- Disposal.

The life cycle of an automated information system consists of:

- Need justification.
- Concept exploration and definition.
- Demonstration and validation.
- Development.
- Production and deployment.
- Operations and support.
- Disposal.

CBTDEVs and MATDEVs must embrace this concept in the development of systems. Failure to consider the life cycle of a system will result in funds being expended for occupational and environmental liability claims, occupational and

environmental compensation claims, and system and facility design retrofits to name just a few.

Current occupational and environmental health problems created by the operation of systems in the field and the operation, maintenance, and disposal of systems at installations is a direct result of not integrating this concept into the acquisition strategy. Developers must consider:

- The impact that a system is going to have on the health and performance of the soldier.
- The availability of maintenance facilities at those installations where the systems will be deployed.
- The environmental and community health impact of operating and firing systems on installation ranges and the effect of wastes and by-products.

The elimination or reduction of health hazards is critical to the Army now and in the future. It is very difficult to separate occupational health concerns from environmental health concerns. Ultimately, the basis for most environmental problems is a relationship to human health concerns. We often have had to initiate remediation and restoration activities, not because the problem was an aesthetic one, but because the problem could potentially impact on the health of people. From the occupational health standpoint, if you eliminate or reduce hazardous materials you will eliminate or reduce occupational exposures to workers. By reducing occupational health exposures, impact on the environment is also reduced (i.e., air, soil, and water). This then results in reducing environmental health exposures to people.

The Army is proud of its HHAP. The key to the reduction of health hazards is "leadership." Each person involved in logistics, acquisition, and combat and materiel/system development is responsible for ensuring health hazards are considered and eliminated or minimized. To accomplish this, AMEDD must provide a basic knowledge and understanding of what health hazards should be addressed when developing a system and what is required to eliminate or minimize the hazards.

INTRODUCTION

■ The primary objective of the HHAP is to consider and eliminate or control health hazards associated with the LCM of weapons, equipment, clothing, training devices, materiel, and information systems.

The Army's health hazard activities are linked inextricably with its military combat doctrine and integration of Army capabilities. The HHAP supports the four elements of combat power: maneuver, firepower, protection, and leadership. It also supports the entire breadth and diversity of the Army technology base.

Health hazard issues, if not managed effectively, can consume funds needed elsewhere and hinder training and mobilization. There will be faster, longer range, and higher technology weapons in the future. Training with this equipment creates the potential for increased adverse health hazards exposures, a decrease in soldier survivability, and an increase in environmental contamination. Proper health hazard management is critical to protect Army resources and to ensure high quality and realistic training.

Health hazard leadership can be achieved only if health hazard and human performance concerns are integrated into Army decision making and activities. Army research, development, acquisition, operations, maintenance, demilitarization, and disposal strategies will include these concerns from the outset so that health hazard and human performance issues are identified and resolved in a timely fashion. This management will enhance the Army's transition to a smaller force with a quick response capability.

INTRODUCTION

Background

As Army institutions go, the HHAP is a relatively “new kid on the block.” Although HHA-type activities were conducted by AMEDD during World War II (Gaydos 1988), the current program’s official beginnings trace back only to the mid-1970s:

- 1976** Questions about blast overpressure hazards surfaced in a general officer decision meeting for the Army’s new 155mm towed howitzer. Early work was conducted informally, and somewhat irregularly, by the MRMC, in alliance with the U.S. Army Human Engineering Laboratory.
- 1981** The Surgeon General of the Army approved the formal establishment of the HHA program, assigning specific responsibilities to participating elements of the AMEDD.
- 1983** The Army regulation (AR) governing HHA, Health Hazard Assessment Program in Support of the Army Materiel Acquisition Decision Process (AR 40-10), was published. Since then, the program has made great strides, providing key support to the Army’s materiel acquisition efforts. (AR 40-10 was updated in 1991.)
- 1985** The Army established a new program called MANPRINT. MANPRINT emphasizes man-system integration—the incorporation of human considerations into design and development of materiel systems to ensure operability and supportability (AR 602-2). This program placed HHA under a common umbrella with HFE, systems safety, manpower, personnel, and training. In terms of general approach and methods used, the HHA program shares much in common with the HFE and systems safety programs, which have been intimately involved in HHA activities for many years (e.g., safety assessment reports routinely address health hazard issues).

INTRODUCTION

Key Definitions

Health hazard—An existing or likely condition that can stem from:

- System design,
- Environment,
- Doctrine,
- Operations (uses/scenarios),
- Misuse, and
- Malfunction

that is inherent to the use of materiel, and can cause:

- Death,
- Injury,
- Acute or chronic illness,
- Disability,
- Reduced job performance (due to illness, injury, or disability), and
- Environmental impact.

Our materiel and operations are the focus for HHAs, not enemy weapons, operations, or local infectious diseases. Notice the “can cause” scope encompasses performance aspects; the interplay between biomedical effects and performance effects can be substantive and complex.

Health hazard assessment—The process of identifying, evaluating, and controlling risks to the health and effectiveness of personnel who test, produce, use, maintain/repair, or support Army systems. The HHAP mobilizes resources to apply biomedical knowledge and principles in direct support of Army officials engaged in developing, manufacturing, operating, maintaining, demilitarizing, and disposing of materiel systems. In civilian circles, the HHA most closely relates to aspects of:

INTRODUCTION

- Occupational health.
- Preventive medicine.
- Environmental medicine.
- Industrial hygiene/safety.
- Pollution prevention.

However, certain characteristics give the Army's HHAP a distinctive character, especially the emphasis on:

- Operator-system interactions.
- Unique aspects of military operations.

Program Goals, Objectives, and Principles

The overall *goals* of the HHAP are to:

- Bolster war-fighting capabilities by conserving or enhancing fighting strength.
- Help ensure successful Army modernization in a safe, efficient, cost-effective manner.

The program's *objectives* include:

- Prevent combat casualties and performance decrements caused by routine operation of our own combat systems.
- Enhance soldier performance and system effectiveness.
- Reduce health-related readiness deficiencies.
- Reduce system retrofit requirements.
- Reduce disability compensation liabilities.
- Reduce environmental contamination (pollution prevention).

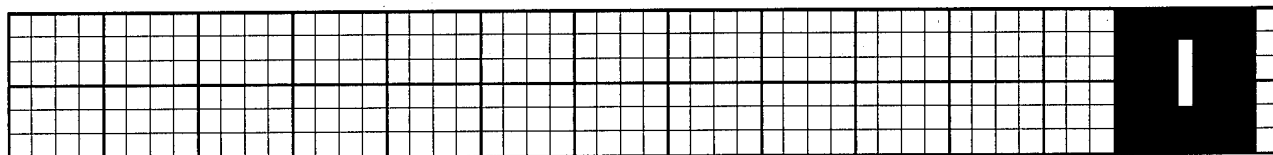
In terms of policy, HHA stresses key *principles* common to every MANPRINT domain:

INTRODUCTION

- Maintain early and continuing involvement in system development.
- Perform total system and total life cycle evaluation.
- Emphasize realistic empirical data for assessment efforts.

INTRODUCTION

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Health Hazard Categories

■ The following information was adapted from U.S. Department of the Army, *Health Hazard Assessment Program in Support of the Army Materiel Acquisition Decision Process*, Washington, D.C.: DA, 1991, AR 40-10, Appendix C: 12-13.

Acoustical Energy

Description: Potential energy in a pressure wave, transmitted through air, which can cause hearing loss and could damage internal organs.

Examples:

- Steady-state noise—engines and helicopter rotors.
- Impulse noise—small arms.
- Blast overpressure—mortars, towed artillery (free-field wave)
heavy weapons on crew-served vehicles (complex wave).

Related publications:

- Preventive Medicine (AR 40-5).
- Noise Limits for Army Materiel [Military Standard (MIL-STD)-1474].
- Acoustical Noise Limits in Helicopters (MIL-STD-1294).
- Hearing Conservation (DA PAM 40-501).

HEALTH HAZARD CATEGORIES

Biological Substances

Description: Pathogenic microorganisms, their toxins and enzymes.

Examples: Sanitation concerns such as waste disposal, food handling, and personal hygiene.

Related publications:

- AR 40-5.
- Field Hygiene and Sanitation [Field Manual (FM) 21-10].
- Occupational and Environmental Health: Food Service Sanitation [Technical Bulletin Medical (TB MED) 530].
- Occupational and Environmental Health: Sanitary Control and Surveillance of Field Water Supplies (TB MED 577).

Chemical Substances

Description: Excessive airborne concentrations of mists, gases, vapors, and particulate matter; also toxic liquids and solids.

Examples:

- Combustion products from weapons or engines.
- Exposure via inhalation, ingestion, dermal or eye contact.

Related publications:

- AR 40-5.
- MIL-STD-1472.
- Human Factors Engineering Design for Army Materiel (MIL-HDBK-759).
- 21 Code of Federal Regulations (CFR) 177, Food and Drugs.
- 21 CFR 182, Food and Drugs.
- 29 CFR 1910, Occupational Safety and Health Standards.

HEALTH HAZARD CATEGORIES

Oxygen Deficiency

Description: Sudden reduction of atmospheric oxygen to <21 percent (by vol).

Examples: Confined spaces and high altitudes can cause shortness of breath and impaired vision, coordination, and judgment, progressing to unconsciousness and death.

Related publications:

- Medical Problems of Man at High Terrestrial Elevations (TB MED 288).
- CD-Working in Confined Spaces (NIOSH Pub. No. 80-106).
- 29 CFR 1910.
- American National Standards Institute (ANSI) Z117.1-1989, Safety Requirements for Confined Spaces.

Radiation Energy

Description:

- Ionizing—any form of radiation sufficiently energetic to ionize molecules in matter.
- Nonionizing—emissions from the electromagnetic spectrum with insufficient energy to ionize molecules.

Examples:

- Ionizing—alpha and beta particles, gamma and x-rays, neutrons.
- Nonionizing—ultraviolet, visible, infrared, microwave, and radiofrequency radiation.

Related publications:

- AR 40-5.

HEALTH HAZARD CATEGORIES

- Control and Recording Procedures for Exposure to Ionizing Radiation and Radioactive Materials (AR 40-14/DLAR 1000.28).
- Control of Health Hazards from Lasers and Other High Intensity Optical Sources (AR 40-46).
- Safety Requirements for Military Lasers (AR 385-9).
- Ionizing Radiation Protection (Licensing, Control, Transportation, Disposal, and Radiation Safety) (AR 385-11).
- Safety Design Requirements for Military Lasers and Associated Support Equipment (MIL-STD-1425).
- Occupational and Environmental Health: Control of Health Hazards from Protective Materiel Used in Self-Luminous Devices (TB MED 522).
- Control of Hazards to Health from Microwave and Radio Frequency Radiation and Ultrasound (TB MED 523).
- Occupational and Environmental Health: Control of Hazards to Health from Laser Radiation (TB MED 524).
- 10 CFR 0-199, Nuclear Regulatory Commission.
- 21 CFR 1040, Performance Standards for Light-Emitting Products.

Shock

Description: Mechanical impulse or impact to the body.

Examples:

- Acceleration—recoil from weapon.
- Deceleration—opening of parachute harness.

Related publications:

- MIL-STD-858, 26 June 1969, Testing Standard for Personnel Parachutes.

HEALTH HAZARD CATEGORIES

- MIL-STD-1290A, 26 September 1988, Light Fixed and Rotary Winged Aircraft Crash Resistance.

Temperature Extremes

Description: Injuries from excessive heat and cold, which can be exacerbated by humidity.

Examples:

- Heat—heatstroke, hyperthermia.
- Cold—frostbite, hypothermia.

Related publications:

- AR 40-5.
- MIL-STD-1472.
- Cold Injury (TB MED 81/NAVMED P-5052-29/AFP 161-11).
- Medical Problems of Man at High Terrestrial Elevations (TB MED 288).
- Occupational and Environmental Health: Prevention, Treatment, and Control of Heat Injury (TB MED 507/NAVMED P-5052-5/AFP 160-1).

Physical Trauma

Description: Injury to eyes or body from impact or strain.

Examples:

- Penetrating.
- Blunt—crush injury, bruise.
- Musculoskeletal—lifting heavy equipment.

HEALTH HAZARD CATEGORIES

Related publications:

- AR 40-5.
- Occupational and Environmental Health (TB MED 506).
- 29 CFR 1910.
- Practice for Occupational and Educational Eye and Face Protection (ANSI Z87.1-1979).

Vibration

Description: Adverse health effects caused by contact of oscillating mechanical surfaces with the human body.

Examples:

- Whole body—aircraft and vehicle operators and passengers.
- Segmental—operators of hand-held power tools.

Related publications:

- MIL-STD 1472.
- Guide for the Evaluation of Human Exposure to Whole-body Vibration (ANSI S3.18-1979).
- Guide for the Evaluation of Human Exposure to Whole-body Vibration [International Standards Organization (ISO) 2631-1978].

Effects of Health Hazards

■ Exposure to one or more health hazards does not necessarily injure a soldier or make him sick. The effects of a hazardous environment depend on the:

- Intensity or amplitude.
- Duration.
- Number of repetitions.
- Other aspects of the exposure.
 - Potential routes of exposure.
 - Populations at risk.
 - Chemical(s) content.
 - Possible synergism.
 - Physical aspects.

The immediate functional impact on the soldier can range widely from negligible effects to complete incapacitation, even death. However, three general functional stages can be distinguished:

- **Performance limited**—Sensory decrements and/or minor injury that leaves the soldier capable of performing at a constructive level with, at most, minor medical attention. Examples include:
 - Minor hearing loss.
 - Mild hypoxia.
 - Muscle strain.

EFFECTS OF HEALTH HAZARDS

- **Physiologically distressed**—Physiological distress and/or moderate injury that seriously compromises the soldier's ability to perform his combat role and possibly requires substantial medical attention. Examples include:
 - Dizziness.
 - Moderate nausea.
 - Severe fatigue.
- **Incapacitated**—Effects rendering the soldier nonfunctional and incapable of caring for himself. Examples include:
 - Carbon monoxide poisoning.
 - Combat exhaustion.
 - Serious burns.

Many of the effects of health hazards are not immediate—they may appear only after months or years of exposure. While such effects may not rapidly impact the soldier's performance, they can limit his long-term contributions to the Army and may cause serious health problems in the future. Examples of delayed or "chronic" effects include:

- Cancers.
- Organ system disorders (such as liver damage or severe hearing loss).
- Psychiatric disorders.
- Birth defects.
- Genetic mutations.
- Metabolic/biochemical disorders.

The Health Hazard Assessment Process

General Discussion

■ HHAs must be conducted during **all** acquisition programs, including product improvements, materiel changes, nondevelopmental items (NDIs), and developmental programs. The results of an HHA are reported in an HHA Domain Report. This document provides a standard structure and approach for assessing system-generated threats to the health of soldiers and Department of Defense (DOD) personnel. HHA Domain Reports support the preparation of:

- MANPRINT Assessments.
- System MANPRINT Management Plans (SMMPs).
- Test and Evaluation Master Plans (TEMPs).
- Detailed Test Plans (DTPs).
- Market Investigations (MIs).
- Safety Releases.
- System technical and training publications.
- Milestone decision reviews.
- Statements of work (SOWs).
- Requests for Proposal (RFPs).
- Source Selection Evaluation Boards (SSEBs).

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In addition, these reports provide the CBTDEV and MATDEV with guidance on methods to mitigate system-specific health hazards.

The objectives of addressing health hazards during Research, Development, Test, and Evaluation (RDT&E) are to:

- Avoid surprises.
- Serve as sound stewards of our human resources.
- Preserve and protect the health of soldiers and DOD personnel.
- Reduce degradation of soldiers' performance and enhance systems' effectiveness.
- Enhance system design by eliminating health hazard-related retrofits.
- Reduce health hazard-related training and operational restrictions that compromise readiness.
- Reduce compensation claims.
- Reduce environmental contamination (pollution prevention).

Health hazard issues must receive attention throughout all phases of an acquisition program. However, early consideration of health hazard issues has greater potential for influencing design and process changes to prevent health hazards. Also, it will avoid program delays and costly design modifications.

- Health hazard issues are first included in the SMMP.
- The Initial Health Hazard Assessment Report (IH HAR) examines lessons learned on predecessor or similar systems and commonly establishes health hazard data requirements for inclusion in the SMMP, TEMP, and DTPs.
- Subsequent reports evaluate health hazard data acquired through test and evaluation or other documented sources. They recommend methods to eliminate or control exposures and establish the risk of noncompliance. Multiple updated reports may be prepared as data become available.

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- Medical research to support HHAs may be needed if a system has a hazard for which there is no existing health standard or if the Army uses require *military unique standards* (e.g., liquid gun propellant). Early identification of biomedical (physiological and toxicological) data base voids is important, since generating data may require considerable time. Required medical research must be developed parallel to materiel development.

Procedures

HHA support organizations and procedures vary with the support requirement and acquisition phase. (See the Glossary of Terms for detailed definitions of all materiel acquisition phases and milestones.)

- **Technology Base Activities.** Basic biomedical research keyed to the Science and Technology Objectives of the Army Technology Base Master Plan is conducted by the MRMC through its subordinate laboratories. Technology base research requirements are established by MRMC in coordination with developers. Once requirements are defined, a medical research plan will be proposed to the MATDEV. This may involve coordination with the U.S. Army Medical Command (MEDCOM) or the OTSG. Current science and technology objectives for MRMC are listed in Table 1-1.
- **Requirement Generation.** Health hazard constraints are identified in Mission Need Statements (MNS), Operational Requirements Documents (ORDs), and SMMPs. This support is provided by both the AMEDDC&S, environmental science officers, industrial hygienists, environmental health specialists, etc., assigned to Preventive Medicine Activities collocated with TRADOC battle labs and schools. CBTDEVs/MATDEVs should contact the HHA points of contact (POC) listed in Appendix A for identification of their installation focal point for review of requirements documents and MJWG support.

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Table 1-1
 Science and Technology
 Objectives

Objectives	Responsible Laboratory
*Performance Limits (heat, cold, nutrition status, etc.)	USARIEM
*Sleep and Performance (inadequate restorative sleep)	WRAIR
*Laser Impacts on Performance (determine, minimize)	WRAIR
*Electromagnetic Radiation Bioeffects (criteria, models)	WRAIR
*Visual Performance (methods, criteria, models)	USAARL
*Nutritional Strategies (physical/mental performance)	USARIEM
*Musculoskeletal Injuries (modify risk factors)	USARIEM
*Laser Bioeffects (ocular effects to update TB MED 524)	WRAIR
*Environmental Injury (prevent, treat)	USARIEM
Toxic Hazard Bioeffects (health protection criteria)	WRAIR
Nonauditory Blast Bioeffects (criteria, models)	WRAIR
Physical Performance (strength, load carriage, etc.)	USARIEM
Military Life and Mental Health (counteracting stresses)	WRAIR
Repeated Impact Jolt (tolerance and protection criteria)	USAARL
Laser Injury Treatment (ocular injury)	WRAIR
Aviator Performance (means to optimize physical/mental)	USAARL
Auditory Blast Bioeffects (protection criteria)	USAARL
Field Water and Sanitation (criteria and doctrine)	WRAIR
Military Acoustical Hazards (design/protection)	USAARL
Vibration Bioeffects (exposure criteria)	WRAIR
Impact Protection (tolerance and protection criteria)	USAARL
Operational Stress (counteracting effects)	WRAIR
Aviator Medical Criteria (cardiovascular and other)	USAARL
Live Fire/Pulmonary (methods, criteria, models)	WRAIR

*Asterisk designates Army STOs.

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- **Concept Exploration and Definition.** CBTDEVs/MATDEVs request an IHHAR during this phase. The request is routed through the Major Army Command (MACOM) Surgeon, USAMC, to CHPPM/AEHA. For PEOs and other non-USAMC developers, requests should go through the USAMC Surgeon's Office. The intent is to establish the USAMC Surgeon's Office as the "initial" POC for all HHA requests. USAMC, via its Major Subordinate Commands (MSCs), provides matrixed HHA support to PEO-managed programs. If a system has no apparent health hazards, or if all potential health hazards are adequately controlled, USAMC may perform the HHA. If the system has more complex health hazard issues and requires considerable technical effort, CHPPM/AEHA becomes the lead independent medical assessor (IMA) who prepares the IHHAR. IMAs may include both CHPPM/AEHA or MRMC, depending on the issues being addressed. Once CHPPM/AEHA has received the request, subsequent HHA support may be coordinated directly for that system. The completed IHHAR is routed back through the MACOM for transmittal to the developer.
- **Demonstration and Validation.** Health hazard data requirements identified in the IHHAR are included in TEMP and DTPs by the MATDEV. Data collection is a MATDEV's responsibility. If an initial report was requested and prepared, the MATDEV will forward health hazard data to the IMA for evaluation. If an initial report was not previously requested, the materiel developer will request support through the MACOM Surgeon to CHPPM/AEHA or MRMC as discussed above. Results of HHAs are used in system engineering to reduce risk. Developer risk reduction efforts will be validated by MATDEV testing and further evaluation by the IMA.
- **Engineering and Manufacturing Development.** Health hazard activities in this phase continue the efforts established in the previous phase. The IMA continues to assess developer generated data and institutes risk reduction methods. The aim

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is to bring all health hazard issues to resolution prior to Milestone III.

- ***Production and Deployment.*** Developers incorporate special operational procedures required to mitigate or control health hazards into doctrinal, operational, maintenance, and training publications and materials. Unresolved health hazard issues will be evaluated during postproduction testing, and the data forwarded to the IMA.
- ***Operations and Support.*** Health hazard issues that are identified after fielding will be brought to the attention of the USAMC Surgeon's Office. Request for support will be coordinated with MEDCOM through CHPPM/AEHA and MRMC for appropriate disposition. Product improvements and other modification programs follow this same process.
- ***Required Documentation and Lead Times.*** To ensure HHA requests are processed expeditiously, it is important to provide adequate supporting documentation with the request. The required documentation may, of course, differ with each program and may include:
 - Safety Assessment Reports (SARs).
 - ORD.
 - MNS.
 - SMMP.
 - TEMP.
 - DTP.
 - Acquisition Strategy (AS).
 - Independent Evaluation Plan (IEP).
 - Integrated Logistic Support Plan (ILSP).
 - Technical Testing (TT)/User Testing (UT) Test Reports.
 - Program Review Documentation.
 - Operational Mode Summary/Mission Profile (OMS/MP).
 - Previously developed data from commercial sources, other Federal services or agencies, or foreign military services.

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- Sampling data on test results (from measures of acoustic energy, biological substances, chemical substances, oxygen deficiency, radiation energy, shock, temperature extremes and humidity, trauma, vibration, etc.).
- Record of Environmental Consideration.
- Waste Stream Analysis Report.

HHa support for most systems requires 90 days advance request to assess a system and prepare the report. If the assessment supports other program documentation (e.g., MANPRINT Assessment), additional time should be allowed to coincide with the preparation requirements of that specific document.

- **Source Selection.** MATDEVs establish SSEBs to choose a contractor or offeror to provide/develop materiel for the Army. Health hazard technical support of SSEBs may be requested via the USAMC Surgeon's Office (see Appendix B for a source selection evaluation primer). An IMA will be designated by the MEDCOM to provide the necessary support. Support of SSEBs is reimbursable, and the designated IMA will provide support on an as-needed basis.
- **Toxicity Clearances.** A toxicity clearance is a request for approval recommendation of single articles or compounds that are being considered for use by the Army. They require a yes/no judgment based upon potential toxicity and require no risk assessment codes (RACs). All requests for medical support needed to conduct toxicity clearances will be sent through the MACOM Surgeon to CHPPM/AEHA. As with HHA requests, 90 days lead time and supporting documentation are required to ensure support is executed expeditiously. Documentation may include:
 - Chemical formulas.
 - Other chemical names or synonyms.
 - Any history of toxicity testing in animals with these specific compounds or the treated materials, specifically in

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regard to skin and eye irritations. Any epidemiological information available regarding the finished product.

- Chemical comparison of these materials/compounds/fabric treatments to any others that have already received a toxicity clearance and toxicity information regarding the approved chemical.
- Information on the quantity of material/chemical/treated materiel that has been used since the formulation has been on the market and possible customer references as to the lack of health-related problems with its use.

Points of Contact

To obtain health hazard services, see Appendix A for appropriate POCs.

System Analysis Elements

What key elements are essential in analyzing a system? In general terms, three types of information must be available:

- ***Descriptive information*** about the system, including a comprehensive accounting of:
 - Components.
 - Subsystems.
 - Special materials.
 - Simulators and other training devices.
 - Special support and maintenance equipment.
 - Special salvage, demilitarization, or disposal equipment.

Also important is a complete description of how the system will be employed, such as:

- Operating/training doctrine.

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- Logistics support concepts (including all levels of maintenance).
- Salvage/demilitarization/disposal concepts.
- Nuclear, biological, and chemical requirements.
- Environmental conditions.
- **Quantitative information** about the system, including hazard-related data (e.g., noise and vibration signatures) from:
 - Technical testing.
 - User testing.
 - Special hazard evaluations.
 - Previous HHAs.
 - Mishap reports.
 - Safety incidents.
 - Modeling efforts.
 - Data from a commercial manufacturer or other military service, usually for NDIs.

In the case of an IHHA, only data from a predecessor system may be available, if data are available at all. In the absence of quantitative data, definitive statements about levels of risk are difficult. Without adequate data, there should be a conservative estimate of the risk (error on the side of the soldier), and this estimate should not change unless adequate data is received.

- **Health standards** against which to judge the health-threatening characteristics of the system can take several forms:
 - Medical exposure limits.
 - Health conservation standards.
 - Materiel design standards.

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Usually these are *published in Army documents* (e.g., TB MEDs, MIL STDs, military specifications, ARs), but occasionally these are *national standards* (e.g., Occupational Safety and Health Administration, ANSI) or *international standards* (e.g., International Standards Organization). Additionally, the results of emerging biomedical research may provide the basis for military-unique standards. Rules for applying these standards, both formal and informal, are necessary to ensure relevance and consistency. Though often not available, comprehensive *biomedical data bases* are very helpful in gauging real levels of risk, especially when quantified hazards exceed established limits.

CHPPM/AEHA is currently developing a technical desk guide on medical criteria and standards for HHA of Army materiel and systems which will address the health hazard categories and provide the following information for each category:

- Definition of hazards.
- Hierarchy of criteria and standards.
- Methods of developing Army specific criteria/standards.
- Methods for measuring hazards/interpreting health risk.
- References for criteria/standards.
- Hazard measurement methods.

System Analysis and Hazard Identification

The foundation of the HHA Report process is the careful analysis of the physical system and the doctrine for its use in identifying potential health hazards. The following provide important clues or contributing factors regarding potential health hazards:

- All components and subsystems.
- All phases of the system's life cycle:
 - Manufacturing.
 - Fielding.
 - Shipping.

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- Storage.
- Operational use.
- Repair.
- Maintenance.
- Salvage.
- Demilitarization.
- Disposal.
- All personnel who will interact with the system, such as:
 - Manufacturers.
 - Operators.
 - Passengers.
 - Nearby troops.
 - Maintainers.
 - Logistics support personnel.
 - Trainers.
- Special operating conditions, such as:
 - NBC operations.
 - River crossings.
 - Airdrops.
 - Smoke/obscurant operations.
- Anticipated environmental conditions, such as:
 - Night.
 - Rain/Fog.
 - Desert.
 - Tropics.
 - Arctic.
 - High altitude.

Obvious health hazard indicators include components that generate microwaves, vibration, or toxic substances; *less obvious*

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indicators include heat build-up during NBC operations or infrared radiation from light sources. The system-based analysis provides a comprehensive inventory of hazardous entities that could reasonably be expected to place personnel at risk.

Data Analysis

For each hazard identified, the medical assessor next analyzes the quantitative data available. The quality, completeness, and validity (conforming with operational concepts) of the data are determined first; serious deficiencies prompt recommendations for future data collection. Raw or intermediate data may need to be reduced, converted to different units of measure, or reorganized to be suitable for interpretation.

Those data adequate for interpretation are compared to pertinent health standards to ascertain whether the quantified levels are acceptable, given the frequency and duration of exposure expected from relevant scenarios (e.g., training, maintenance, resupply, disposal). Where appropriate, the effects of required or available protective equipment (e.g., helmets, hearing protectors) must be accounted for in determining effective exposure profiles.

Table 1-2
Hazard Probability

Descriptor	Level	Specific Individual Item	Fleet or Inventory
Frequent	A	Likely to occur frequently	Continuously experienced
Probable	B	Will occur several times in the life of an item	Will occur frequently
Occasional	C	Likely to occur sometimes in life of an item	Will occur several times
Remote	D	Unlikely but possible to occur in life of an item	Unlikely but can reasonably be expected to occur
Improbable	E	So unlikely, it can be assumed occurrence may not be experienced	Unlikely to occur, but possible

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Table 1-3
Risk Assessment Codes

Hazard Severity Categories	Hazard Probability Levels				
	A	B	C	D	E
	Frequent	Probable	Occasional	Remote	Improbable
I - Catastrophic	High (1)	High (1)	High (1)	High (2)	Medium (3)
II - Critical	High (1)	High (1)	High (2)	Medium (3)	Low (4)
III - Marginal	High (2)	Medium (3)	Medium (3)	Low (4)	Low (5)
IV - Negligible	Medium (4)	Low (5)	Low (5)	Low (5)	Low (5)

■ Source: *Systems Safety Engineering and Management (AR 385-16) and AR 40-10.*

When pertinent health standards do not exist, MRMC may review or develop a data base (in coordination with CHPPM/AEHA) and recommend appropriate criteria.

Risk Assessment

The next step is to estimate the degree of risk associated with each hazard by assigning a RAC. (See AR 40-10, Appendix B, for risk decision authority levels.) The RAC (tables 1-2 and 1-3) is an index of a hazard's criticality and is useful in establishing priorities for control actions. Two factors determine the actual RAC—hazard severity and hazard probability.

Reflecting the worst potential consequence, **hazard severity** is defined in terms of degree of injury or occupational illness that could result. Categories of severity include:

- Category IV—Negligible (less than minor).
- Category III—Marginal (minor).
- Category II—Critical (severe).
- Category I—Catastrophic (death/limb loss).

Hazard probability reflects the likelihood of occurrence, ranging from improbable to frequent. The RAC integrates both

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hazard severity and probability to yield a number between 1 and 5, with 1 reflecting the highest degree of risk.

The goal of the HHAP is to identify and evaluate potential health hazards early in a system's life cycle and to influence system design to eliminate these hazards.

Development of Recommendations

Based on the analysis of each hazard, the IMA next formulates recommended actions to reduce, control, or eliminate hazards posing unacceptable degrees of risk. The types of control options available appear in table 1-4 (also see Appendix C).

Effective design features during early system development are obviously the most desirable of all options, but redesigning or retrofitting the system may be needed to reduce the intensity or level of hazards at crew locations. Engineering measures may focus on the hazard source, transmission routes, or active crew station conditioning options.

Protective devices are primarily systems worn by individuals to protect:

- The head, eyes, ears, or face (e.g., helmets, laser protective goggles).
- Other portions of the body (e.g., protective clothing or gloves).
- The respiratory tract.

They also may regulate body temperature (e.g., cooling vests, cold weather clothing). Most protective systems are passive, but they may operate actively, as in the case of cooling vests and active hearing protectors.

Administrative controls usually are geared around the soldier's medical or physiological state. Personnel selection criteria might exclude soldiers already exhibiting substantial hearing loss from

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operating a very noisy system. Examples of occupational health monitoring procedures are periodic audio-metric testing and radiation film badges. Environmental criteria might take the form of limiting training during very hot climatic conditions.

Operating controls encompass limitations on the:

- Operating cycle (duration or frequency).
- Crew locations or posturing (consider crouched mortarmen).
- Operating mode (e.g., vehicle speed).
- System configuration (e.g., tank hatches closed).

Training in safe operations, to include use of protective devices, is typically an important consideration. Physical conditioning or environmental adaptation may also be appropriate to consider.

Table 1-4
Health Hazard Control
Options

Type	Option
Engineering Controls	Source modification Materials substitution Containment/isolation/shielding Environmental conditioning/filtering/ventilation
Protective Equipment	Trauma/burn protection Respiratory protection Sensory protection Body temperature protection
Administrative Controls	Personnel selection/retention criteria Occupational health monitoring Environmental criteria
Operating Controls	Training/conditioning/adaptation Operating cycle/timing Crew positioning System configuration and mode

See also Appendix C, HHA Fact Sheet.

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For each hazard exceeding established exposure standards, recommend one or more control options. Tailor the selection of control options to the specific system and its operational requirements. Hazard controls may be needed for maintenance and support personnel as well as crew-members and passengers. More than one type of control option may be needed for some hazards. Likewise, practical considerations may necessitate both short- and long-term control options. If the analysis of data reveals deficiencies in available data, the recommendations should also include requirements for additional data collection.

Research Supporting Health Hazard Assessment

Research Roles

■ Though often operating “behind the scenes,” research plays three major roles in the HHAP:

- Developing new tools.
- Conducting special studies.
- Performing medically related test and evaluation.

Developing New Tools

Routine functioning of the HHAP relies on key tools (table 1-5) that include:

- Health standards.
- Biomedical data bases.
- Prediction models.
- Protection evaluation methods.
- Materiel evaluation methods.
- Improved protection techniques.
- Troop health indicators.

For a given health hazard, some or even all of these tools may be deficient or lacking. For example, the existing health standard for impulse noise is based on a very limited data base and has never been validated (Leibrecht and Patterson 1986). MRMC is

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performing research that will provide validation on the revision of the health standard.

Forward-looking research serves to develop new or improved tools to advance HHA capabilities. Such research usually consists of:

- Laboratory investigations (using both animals and humans).
- Technology or methodology development.
- Mathematical modeling.

It also may involve field evaluations (more often with humans, but occasionally with animals) and epidemiology. To reach maturity, these types of research normally require multiphase programs,

Table 1-5
HHA Tools

Type	Description
Health standards	Documents (e.g., noise exposure limits) specifying conditions of acceptable risk for individual hazards
Biomedical data bases	Systematic collections of empirical data on basic bioeffects, exposure-injury relationships, mechanisms of injury, and material characteristics
Prediction models	Mathematical or analog models for predicting the extent of injury based on quantitative exposure characteristics
Protection technology	Systems, components, and subsystems for reducing effective exposure to acceptable levels, given unacceptable source levels
Methodology for:	Equipment, facilities, and procedures for:
Protective device evaluation	Measuring effectiveness of protective systems
Hazard measurement	Quantifying health hazard characteristics of material
Health monitoring	Assessing key health characteristics of personnel

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substantive resources, and long-term commitments. Thus, they depend on formal planning, programming, and budgeting to provide a stable funding environment.

Establishing Research Requirements

Health hazard research deficiencies and requirements should be addressed in the Enhanced Concept Based Requirements System and should be identified in the Army modernization plan and Army Science and Technology Master Plan as appropriate. Incorporating health hazard requirements will require close coordination between planning agencies, HQ TRADOC, AMEDDC&S, MRMC, and MEDCOM. Additionally, critical health hazard requirements should also be addressed in the Warfighting Lens Analysis (WFLA) for TRADOC funding prioritization. WFLA is the material analytical process within the ECBRS. Requirements should be submitted as a portion of the AMEDDC&S Branch Assessment.

The following individuals should notify the MEDCOM through MRMC when potential health hazard research requirements come to their attention:

- CBTDEVs.
- System developers.
- Technology developers.
- Test and evaluation personnel.
- Human factors and system safety personnel.
- Logistics personnel.

The MEDCOM, through MRMC (see table 1-6 for a list of laboratories performing health hazard research functions), will develop biomedical data bases on the mechanism of human physiological and toxicological responses to military-unique exposures common to many weapon systems. MRMC will assist CBTDEV and MATDEV/system developers in the design and execution of developer sponsored studies to obtain required biomedical data.

The important thing is to identify and plan for such requirements as early in a system's life cycle as possible.

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Table 1-6
MRMC Health Hazard
Research Laboratories and
Research Functions

	U.S. Army Aeromedical Research Laboratory (USAARL): Blast overpressure Noise Vibration Shock Thermal stress Oxygen deficit
	Walter Reed Army Institute of Research (WRAIR): Blast overpressure Microwaves Millimeter waves
	Occupational Toxicology Detachment of WRAIR: Smokes Obscurants Combustion products Toxic effluents
	Laser Bioeffects Research Detachment (LAIR) of WRAIR: Lasers Light
	U.S. Army Research Institute of Environmental Medicine (USARIEM): Heat Cold Overexertion Altitude

MJWG and Installation Preventive Medicine

■ The MJWG is the primary body for integrating the health hazard domain with the six other MANPRINT domains:

- System Safety.
- HFE.
- Soldier Survivability.
- Manpower.
- Personnel.
- Training.

The responsibilities of the MJWG are to:

- Develop and maintain a SMMP.
- Provide expertise necessary to focus on all seven MANPRINT domains.
- Identify and manage MANPRINT issues during the materiel acquisition decision process.
- Provide oversight to ensure that MANPRINT is carried out.

Appendix D contains an explanation of the SMMP, MANPRINT process, mission need statement, operational requirements document, and the crosswalking that is essential. Appendix E contains a concept chart for improving early involvement that may prove beneficial in the future.

MJWG AND INSTALLATION PREVENTIVE MEDICINE

Medical participation in the MJWG is normally done by personnel from the AMEDD Center and School or Preventive Medicine Service personnel supporting the system proponent. When done early on, the SMMP is the most important document for having health hazard issues addressed.

The health hazard questionnaires/checklists in Appendix F may be used based on professional judgment and best available information until data becomes available. If personnel are unsure about a potential hazard, the hazard should be included as an issue in the SMMP. The program manager will obtain information to determine if there actually is a hazard. Local Preventive Medicine personnel should raise issues and then evaluate data that has been provided to modify the health hazard issues as appropriate.

CBTDEVs or MATDEVs are responsible for performing testing; Preventive Medicine personnel should not perform this function. Solutions to health hazard issues are the responsibility of the developer. The developer can obtain assistance in formulating a solution from CHPPM/AEHA or MRMC. Local Preventive Medicine personnel should attend all MJWGs and system description meetings within resource constraints. If attendance is not possible, the SMMP and/or other documentation can be reviewed and written input (e.g., DA Form 2028, Recommended Changes to Publications and Blank Forms) can be provided. If a health hazard issue is missed, remember the SMMP is a dynamic document that can be modified/updated anytime. There may be some development efforts that do not formally have "MANPRINT" programs. Health hazards need to be considered for all systems, and an HHA Report is still required.

The Health Hazard, System Safety, and HFE domains do overlap, so it is in your best interest to get acquainted with your local System Safety and HFE personnel. Remember, the developer does not want any "surprises" later on in the acquisition cycle, so raise the issues early as this allows the developer to address a potential problem. If additional technical expertise is needed, refer to Appendix A for POCs.

CONCLUSIONS

■ Early and continuing review of system/subsystem/component health hazards is essential to successful materiel design and development efforts. Effective medical input and evaluation is imperative to ensure that threats to troop health are eliminated or minimized. The Army's HHAP provides resources, tools, and procedures to address systems' health hazards. In supporting the full spectrum of a system's life cycle, a variety of health hazard services is available.

As a major mechanism for effectively integrating human considerations into materiel acquisition, HHA is a key component of the MANPRINT program. To be optimally effective, HHA efforts should be conducted in concert with other MANPRINT activities. There must be careful coordination and interaction between HHA activities and efforts of the other MANPRINT domains to ensure cohesive, comprehensive, and efficient program coverage. The MJWG forms the primary body for integrating HHAs with other MANPRINT domains.

Through membership on the MANPRINT team, the HHA community shares important responsibilities in the Army's modernization efforts. Applying biomedical knowledge and principles to field safer, more effective combat systems yields invaluable payoffs. The ultimate benefits—protecting the health of troops, enhancing system effectiveness and conserving warfighting assets—translate into improved combat readiness for the entire Army.

CONCLUSIONS

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APPENDIX A

Points of Contact

■ This appendix contains:

- A listing of points of contact for health hazard services, including points of contact for Preventive Medicine Service personnel at TRADOC schoolhouse installations.
- A listing of TRADOC MANPRINT points of contact is also included.
- Addresses for obtaining listings of program executive officers; program, project, and product managers; System Safety personnel; Human Factors Engineering personnel; and Pollution Prevention personnel.

**Points of Contact:
Health Hazard Services**

Commander

U.S. Army Center for Health Promotion and Preventive Medicine/
U.S. Army Environmental Hygiene Agency
ATTN: MCHB-MO-A
Aberdeen Proving Ground, MD 21010-5422
DSN 584-2925, Commercial (410) 671-2925

Areas of Expertise:

- Health hazard assessment
- Health hazards
- SMMPs
- Health Hazard Assessment Reports
- SSEB support

POINTS OF CONTACT

Commander

U.S. Army Medical Department Center and School

ATTN: HSMC-FCM

Fort Sam Houston, TX 78234-6100

DSN 471-0775, Commercial (210) 221-0775

Areas of Expertise:

- Requirements documents
- SMMPs
- MANPRINT
- Health hazards

Commander

U.S. Army Medical Department Center and School

Academy of Health Sciences

ATTN: HSHA-PM

Fort Sam Houston, TX 78234

DSN 471-8036, Commercial (210) 221-8036

Areas of Expertise:

- Preventive medicine training
- Health hazard training

Commander

U.S. Army Materiel Command

ATTN: AMCSG-H

5001 Eisenhower Avenue

Alexandria, VA 22333-0001

DSN 284-9470, Commercial (202) 274-9470

Areas of Expertise:

- Health hazards
- Health Hazards Assessment Reports
- MANPRINT
- Acquisition and health

POINTS OF CONTACT

Commander

U.S. Army Medical Command

ATTN: MCHO-CL-W

Fort Sam Houston, TX 78234-6000

DSN 471-8167, Commercial (210) 221-8167

Areas of Expertise/Preventive Medicine Activity Support for:

- SMMPs
- MANPRINT
- Requirements documents
- Health hazards

Commander

U.S. Army Medical Research Materiel Command

ATTN: SGRD-PLC

Fort Detrick

Frederick, MD 21701-5012

DSN 343-7301, Commercial (301) 663-7301

Areas of Expertise:

- Health hazard assessment
- RDTE support coordinator
- Criteria development
- Database development

HQDA (SGPS-PSP-E)

5109 Leesburg Pike

Falls Church, VA 22041-3258

DSN 289-0129, Commercial (202) 756-0129

Area of Expertise:

- Preventive medicine and health policy

POINTS OF CONTACT

TRADOC Surgeon

Headquarters

U.S. Army Training and Doctrine Command

ATTN: ATBO-M

Fort Monroe, VA 23651

DSN 680-2226, Commercial (804) 727-2226

Areas of Expertise:

- Health hazards
- Training and health
- Doctrine and health

U.S. Army Aeromedical Research Laboratory

ATTN: SGRD-UAS

Fort Rucker, AL 36362-5001

DSN 558-6800, Commercial (205) 255-6800

Areas of Expertise:

- RDTE support coordinator
- Acoustical energy
- Criteria development
- Database development

U.S. Army Aeromedical Research Laboratory

Fort Rucker, AL 36362-5001

DSN 558-6896, Commercial (205) 255-6896

Areas of Expertise:

- RDTE support coordinator
- Shock/impact/trauma
- Vibration hazards
- Criteria and database development

POINTS OF CONTACT

U.S. Army Research Institute of Environmental Medicine

ATTN: SGRD-UE-EM

Natick, MA 01760-5007

DSN 256-4832, Commercial (508) 651-4832

Areas of Expertise:

- RDTE support coordinator
- Temperature extremes
- Oxygen deficiency
- Criteria and database development

U.S. Army Research Institute of Environmental Medicine

ATTN: SGRD-UE-OP

Natick, MA 01760-5007

DSN 256-4832, Commercial (508) 651-4832

Areas of Expertise:

- RDTE support coordinator
- Muscle trauma
- Skeletal trauma
- Criteria and database development

Walter Reed Army Institute of Research

ATTN: SGRD-UWH-E

Washington, DC 20307-5100

DSN 291-5380, Commercial (301) 427-5380

Areas of Expertise:

- RDTE support coordinator
- Acoustical energy
- Nonauditory blast
- Criteria development
- Database development

POINTS OF CONTACT

Walter Reed Army Institute of Research
ATTN: SGRD-UWH-I
Washington, DC 20307-5100
DSN 291-5125, Commercial (301) 427-5125

Areas of Expertise:

- RDTE support coordinator
- Nonionizing radiation
- Microwave radiation
- Criteria and database development

Laser Bioeffects Research Detachment
Walter Reed Army Institute of Research
ATTN: SGRD-UWB-L
7914A Drive, Brooks AFB
San Antonio, TX 78235-5000
DSN: 240-4621, Commercial (210) 536-4621

Areas of Expertise:

- RDTE support coordinator
- Nonionizing radiation
- Laser radiation
- Criteria and database development

Occupational Toxicology Detachment
ATTN: OL-AL HSC/OET
Building 824, 2800 Q Street
Wright-Patterson AFB, OH 45433-7947
DSN 785-0607, Commercial (513) 255-0607

Areas of Expertise:

- RDTE support coordinator
- Chemical toxicity
- Health hazards
- Criteria and database development

POINTS OF CONTACT

■ *Source: HQ, MRMC, ATTN: SGRD-PLC, LTC Jim Carroll, Fort Detrick, Frederick, MD 21701-5012. HQ, AMC, ATTN: AMCSG-H, LTC Welford Roberts, 5001 Eisenhower Avenue, Alexandria, VA 22333-0001.*

POINTS OF CONTACT

*Points of Contact: U.S. Army
Medical Command*

Preventive Medicine Services Personnel MANPRINT Joint Working Group (MJWG)

Organization/Installation	POC	Phone Number
Engineer Center/Fort Leonard Wood	HSEP-PM	314 596-1062
Infantry Center/Fort Benning	PVNTMED	DSN 835-1144/3518/1428
Air Defense Center/Fort Bliss	HSHM-PMA	DSN 978-1275/1274
Carlisle Barracks	PVNTMED	DSN 242-3902
Transportation Center/Fort Eustis	HSXH-PMS	DSN 927-4531/5660
Signal Center/Fort Gordon	PVNTMED	DSN 780-4278/2517
Soldier Supt/Fort Benjamin Harrison	HSIP-PM	DSN 699-5210/5213
Intelligence Center/Fort Huachuca	HSXJ-PM	DSN 821-5912
Training Center/Fort Jackson	PVNTMED	DSN 734-4412
Armor Center/Fort Knox	HSXM-PM-IH	DSN 464-3246/7660
Combined Arms Command/Fort Leavenworth	PVNTMED	DSN 552-2246
Logistics Center/Fort Lee	HSXO-PVM	DSN 539-2250/2251
Military Police & Chemical Schools/Fort McClellan	PVNTMED	DSN 865-3634/3726
HQ/TRADOC/Fort Monroe	ATBO-M	DSN 680-2226
Aviation Center/Fort Rucker	PVNTMED	DSN 558-2975
Field Artillery Center/Fort Sill	HSUA-HPM	DSN 639-0237
Ordnance School/APG, MD	PVNTMED	DSN 298-2225
Chaplain School/Fort Monmouth	PVNTMED	DSN 992-2579
JFK Special Warfare Center and School/Fort Bragg	PVNTMED	DSN 236-7133

■ *Source: HQ, USAMEDCOM, ATTN:MCHO-CL-W, LTC Randy Perry, Fort Sam Houston, TX.*

POINTS OF CONTACT

TRADOC MANPRINT
Points of Contact

HQ TRADOC

Ft. Monroe, VA 23651-5000

DSN 680-/COM (804) 727-

Combat Developments

ATCD-RM

Ext. 3477

System Safety

ATOS

Ext. 2193/2845

Training Developments

ATTG-CS

Ext. 5931

Personnel Proponency

ATTG-ILP

Ext. 5658

Health Hazards

ATBO-M

Ext. 2226

Combined Arms Command (CAC)

Ft. Leavenworth, KS 66027

DSN 552-/COM (913) 684-

Combined Arms &

Integration Directorate

ATZL-CD

Ext. 4992/4993

CSS Systems

ATZL-CDE-B

Ext. 5595/5596

C² Directorate

ATZL-CDC-F

Ext. 4980

System Safety

Provided by HQ TRADOC

Command

Safety POCs listed above.

POINTS OF CONTACT

Combined Arms Support Command (CASCOM)

Ft. Lee, VA 23801-5000

DSN 539-/COM (804) 765- *or* DSN 687-/COM (804) 734-

ILS/MANPRINT

ATCL-MRC

687-0578

Institutional Training & Ed

Directorate

ATCL-LCC

539-1779

Safety Manager

ATZM-SO

539-3132/3130

Army Logistics

Management College

(ALMC)

ATSZ-AMA-M

539-4365

Adjutant General School

Ft. Benjamin Harrison, IN

46216-5530

DSN 699-/COM (317) 542-

Combat and Force

Developments &

Personnel Proponency

Adjutant General School

ATZI-AGP

Ext. 4718

Combat and Force

Developments &

Personnel Proponency

Finance School

ATZI-RRP

Ext. 6518

Combat and Force

Developments &

Personnel Proponency

Recruiting and

Retention School

ATZI-RRP

Ext. 4855

Training and Doctrine

Developments

ATZI-DTN

Ext. 4273

POINTS OF CONTACT

System Safety

ATZI-CG-S

Ext. 4524

Personnel Proponency

ATZI-PO

Ext. 4750

Health Hazards

HSIP-PM

Ext. 5210

Air Defense Artillery Center and Ft. Bliss

Ft. Bliss, TX 79916-7000

DSN 978-/COM (915) 568-

Combat Developments

ATSA-CDM-L

Ext. 2623/2320/0707

ATSA-CDM-H

Ext. 1637/2320

Training Developments

ATSA-DTH-G

Ext. 5545

ATSA-DTH

Ext. 3495/1678

System Safety

ATZC-GCS

Ext. 2510/5611

Personnel Proponency

ATSA-ADA

Ext. 3022/3752

Health Hazards

HSIM-PMA-STOP9

Ext. 5525

ARL Field Element

AMSRL-HR-ME

Ext. 3431/2896

ARI

PERI-SB

Ext. 4491

Armor School

Ft. Knox, KY 40121-5000

DSN 464-/COM (502) 624-

POINTS OF CONTACT

Combat Developments
ATZK-CDC
Ext. 2788/8132

Training Developments
ATSB-SBZ-B
Ext. 6365/7530

System Safety
ATZK-CDC
Ext. 2788/8132

Personnel Proponency
ATZK-AR
Ext. 7064/5155

Health Hazards
HSXM-PM-IH
Ext. 6836/7660

Maintenance Training
ATSB-BAA-T
Ext. 5623/6140

ARL Field Element
AMSRL-HR-MH
Ext. 3614/1964

ARI
PERI-IK
Ext. 6928/2613

Army Training Support Center

Ft. Eustis, VA 23604-5166
DSN 927-/COM (804) 878-

Devices Management
Directorate
ATIC-DMR
Ext. 0187

Aviation Center and Ft. Rucker

Ft. Rucker, AL 36362-5000
DSN 927-/COM (804) 878-

Combat Developments
ATZQ-CDC-S
Ext. 4576

Training Developments
ATZQ-TDS-ET
Ext. 5460

POINTS OF CONTACT

System Safety
ATZQ-S
Ext. 2301

Personnel Proponency
ATZQ-AP
Ext. 4313

Health Hazards
Ext. 6894/2975

ARL Detachment
AMSRL-HR-MJ
Ext. 2069/4455/3303

Aviation Logistics School
Ft. Eustis, VA 23604-5414
DSN 927-/COM (804) 878-

Combat Developments
ATSQ-LDC-M
Ext. 6959/6803

Training Developments
ATSQ-LTD-N
Ext. 6658

System Safety
ATSQ-LAC-SO
Ext. 6153/6127

Personnel Proponency
ATSQ-LPN
Ext. 6566

Health Hazards
Ext. 2331/5660

Chaplain Center and School
Ft. Monmouth, NJ 07703-5612
DSN 992-/COM (908) 532-

Combat Developments
ATSC-DCD
Ext. 5147

Personnel Proponency
Washington, DC; DSN 294
COM (202) 653
CHSA-PSB
Ext. 1865

POINTS OF CONTACT

Chemical School

Ft. McClellan, AL 36205-5020
DSN 865-/COM (205) 848-

Combat Developments
ATZN-CM-CS
Ext. 6572

Training Developments
ATZN-CM-FU
Ext. 5089/4779/5260

System Safety
ATZN-CSF
Ext. 4723/5603

Personnel Proponency
ATZN-CM-AP
Ext. 4036

Health Hazards
HSXQ
Ext. 3694

Engineer Center and Ft. Leonard Wood

Ft. Leonard Wood, MO 65473-5000
DSN 676-/COM (314) 563-

Combat Developments
ATSE-CDM
Ext. 7346

Training Developments
ATSE-TD-NE
Ext. 7799

System Safety
ATSE-CDM
Ext. 7346
ATZT-S
Ext. 5002/5008

Personnel Proponency
ATSE-EP
Ext. 5351

Health Hazards
HSEP-PM
Ext. 6861

Evaluation and Standards
ATSE-ES
Ext. 5319

POINTS OF CONTACT

TPO for Breacher and HAB
ATSE-CD-TPO
Ext. 7235

Field Artillery School
Ft. Sill, OK 73503-5600
DSN 639-/COM (405) 351-

Combat Developments	System Safety
ATSF-CSI-P	ATZR-N
Ext. 2807-6558	Ext. 4215/4701

Personnel Proponency	Health Hazards
ATSF-AI-P	HSUA-HPM
Ext. 4970	Ext. 0237

ARL Field Element
AMSRL-HR-MF
Ext. 2409

Infantry Center and Ft. Benning
Ft. Benning, GA 31905-5000
DSN 835-/COM (404) 545-

Combat Developments	Training Developments
ATSH-CDMP	ATSH-V-S
Ext. 1332/1915	Ext. 2571

System Safety	Personnel Proponency
ATZB-SO	ATSH-IPI-P
Ext. 3914/4010/3267	Ext. 5402

POINTS OF CONTACT

Health Hazards
Ext. 1428
Ext. 5493

ARL Detachment
AMSRL-HR-MW

Intelligence Center and Ft. Huachuca

Ft. Huachuca, AZ 85613-5000

DSN 821-/COM (602) 533- *or* DSN 879-/COM (602) 538-

Combat Developments
ATZS-CDI-I
821-5564/5582

Training Developments
ATZS-TDN
879-7859/8173

System Safety
ATZS-LSO
879-2162/2163

Personnel Proponency
ATZS-MI
821-1173

Health Hazards
HSXJ-PM
821-5912

Military Police School

Ft. McClellan, AL 36205-5030

DSN 865-/COM (205) 848-

Combat Developments
ATZN-MP-CCC
Ext. 3101/3510

Training Developments
ATZS-TDN
Ext. 4797/6628

System Safety
ATZN-MP-CSF
Ext. 5238
ATZN-CSF
Ext. 4723/5603

Personnel Proponency
ATZN-MP-P
Ext. 4710

POINTS OF CONTACT

Health Hazards

Ext. 3981

Ordnance Center and School

Aberdeen Proving Grounds,

MD 21005-5201

DSN 298-/COM (301) 278-

Combat Developments

ATSL-CD-MS

Ext. 3375

Training Developments

ATSL-DTD-NE

Ext. 3315/2678

System Safety

ATSL-ACS-SEO

Ext. 3418/3654

Personnel Proponency

ATSL-O

Ext. 5602

Health Hazards

Ext. 2225

Ordnance Missile and Munitions Center and School

Redstone Arsenal, AL 35897-6000

DSN 788-/COM (205) 842- *or* DSN 746-/COM (205) 876-

Combat Developments

ATSK-CMA

788-2981

Training Developments

ATSK-TX

788-6897

System Safety

ATSK-CMT-P

746-9593/9343

Personnel Proponency

ATSK-CMT-P

746-9594

POINTS OF CONTACT

Quartermaster Center and School

Ft. Lee, VA 23801-5030

DSN 539-/COM (804) 765- *or* DSN 687-/COM (804) 734-

Combat Developments

ATSM-CDM

539-3706

Training Developments

(New Systems)

ATSM-CDC

687-6980

System Safety

ATSM-CDM

687-5347

Personnel Proponency

ATSM-QMG

687-4237

Health Hazards

HSXO-PVM

Ext. 1033

Signal Center and Ft. Gordon

Ft. Gordon, GA 30905-5000

DSN 780-/COM (404) 791-

Combat Developments

ATZH-CDM

Ext. 7107/3129

Training Developments

ATZD-DTN

Ext. 6183/7759

System Safety

ATZH-IS

Ext. 3227/7233

Personnel Proponency

ATZH-POE

Ext. 5587

Health Hazards

Ext. 4278/2517

ARI

Ext. 5523/5524

POINTS OF CONTACT

Transportation Center and Ft. Eustis

Ft. Eustis, VA 23604-5000

DSN 927-/COM (804) 878-

Combat Developments

ATSP-CDM

Ext. 2152

Training Developments

ATSP-CDM

Ext. 6963

Automation: ATSP-CDA

Ext. 6692

System Safety

Wheel Vehicle Safety:

ATZF-CSS

Ext. 5605-3995

Personnel Proponency

ATZF-OCT

Ext. 6264

Water Craft Safety:

ATZF-CSS

Ext. 6693

Health Hazards

HSXH-PMS

Ext. 4532

TRADOC Analysis Command—Ft. Benjamin Harrison

Ft. Benjamin Harrison, IN 46216-5000

DSN 699-/COM (317) 543-

Director

ATRC-B

Ext. 6897/6896/6881

POINTS OF CONTACT

Public Affairs Proponent Activity

HQDA, Office of the Chief of Staff of Public Affairs
Fort Benjamin Harrison, IN 46216-6200
DSN 699-/COM (317) 542-

Public Affairs Proponent
SAPA-PA
Ext. 4141

Doctrine and Combat
Developments
SAPA-PA
Ext. 4002

Training Developments
SAPA-PA
Ext. 4013

Personnel Proponency
SAPA-PA
Ext. 4124

■ Source: HQ, TRADOC, ATTN: ATCD-RM, Mr. Steve Dwyer, Fort Monroe, VA 23651-5000.

Other Points of Contact

ODCSPER periodically updates a list of MANPRINT participants that can be obtained by writing:

MANPRINT Points of Contact
HQDA (DAPE-MR)
Washington, DC 20310-0300

The Army Acquisition Executive Support Agency periodically updates a listing of program executive officers and program, project, and product managers that can be obtained by writing:

The Army Acquisition Executive Support Agency
Program Management Division
Building 201, Stop 889
Fort Belvoir, VA 22060-5889

The U.S. Army Safety Center periodically updates a list of system safety personnel that can be obtained by writing:

Commander
U.S. Army Safety Center
ATTN: System Safety
Fort Rucker, AL 36362-5363

The Army Research Laboratory periodically updates a list of Human Factors Engineering personnel that can be obtained by writing:

Director
U.S. Army Research Laboratory
ATTN: AMSRL-HR-M
Human Research and Engineering Directorate
Aberdeen Proving Ground, MD 21005-5245

The Army Acquisition Pollution Prevention Support Office (AAPPSO) maintains a listing of organizations involved in pollution prevention. Information can be obtained by writing:

Army Acquisition Pollution Prevention Support Office
HQ, Army Materiel Command
ATTN: AMCRD-E
Alexandria, VA 22333-0001

POINTS OF CONTACT

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APPENDIX B

Source Selection Evaluation Primer

■ This appendix:

- Provides you with a brief overview of source selection evaluation procedures. Every source selection board will be different; however, the outcome will be the same—a recommendation to the board on a particular system.
- Is based on proceedings of seven source selection boards.
- Contains an introduction in MANPRINT on the source selection process.
- Contains a Source Selection Evaluation Board (SSEB) reference list.

Rather than be thrown into the whirling morass of the SSEB without any hope of understanding what you are doing, or why you are there (for what may seem an inordinate and maddening period of time), the initiates have composed this paper to help you understand what is happening around and to you.

The nature of the SSEB is organic: it will grow, flourish, mutate, degenerate, and die. These phases are inevitable, because each SSEB appears to have its own distinct needs and problems. Area chiefs will think they know what to expect, but their supervisors will change their minds and approaches as developments germinate. Your evaluations will be based on the consumption of volumes of literature both from the offeror and the government. A grand scheme may be presented for you to follow, but you will be asked in midstream to change your approach, or to rewrite your evaluations. Be flexible and adaptive, but fight for your ideas. Many of the

SOURCE SELECTION EVALUATION PRIMER

people on these boards will be found to be quick and incisive themselves. They provide an interesting experience.

When an SSEB is convened, one of you will be called upon to provide your expertise. The SSEB is called together to choose a contractor, or offeror to provide military materiel to the Army. Many aspects of the item will be scrutinized. A new but highly visible area is MANPRINT. One of the areas of MANPRINT is health hazards. It will be your job to assess the potential health hazards posed by the item(s). You might work by yourself and/or with another subject expert such as safety. You will provide and receive input from other members of the board who happen to be lawyers, engineers, administrators, trainers, etc., as well.

Figure B-1 illustrates what the Army does when it wants military materiel. The item or items may be available, but might need to be adapted for a new purpose. Under such circumstances, it/they are called nondevelopment items (NDI). If the Army brainstormers devise a military purpose for an item not yet developed, then a developmental item (DI) is proposed. The main difference is that the NDI may exist for the most part. It is comparable to buying a car. You look at the features, advantages, disadvantages, and costs of several models of a car. Your purchase will depend on your analysis of the observed data. The main difference in this analogy is that the SSEB makes its decision much more slowly. The DI is potentially even more lengthy, because the government is telling the offerors (bidders) what it wants made. Unfortunately, the government may not know how it wants it made.

With both the NDI and the research and developmental item, a request for proposal (RFP) is composed stipulating the desired criteria and testing for the item. With the NDI, the criteria will call for upgrades and specifics that may not have been developed yet. The NDI RFP will have specific criteria the government wants. Since MANPRINT is a relatively new facet of the process, the RFP for the previous NDI was general in its approach to health hazards. The contractors submitted data as best they could, but the data were often lacking in content. Hopefully, future SSEBs will have input from us when they compose RFPs so that offerors will address specific health hazards adequately.

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The offeror will make a proposal stating how he will satisfy the criteria. Your job—should you accept it (and all of you probably will)—will be to see that potential health hazards are adequately addressed. A separate report relating safety and health hazard concerns will be among a plethora of volumes submitted by the contractor. Unfortunately, not all your information will be in this text, and you will have to look through most of the other volumes to ensure you have not missed anything.

The proposal is sent to the SSEB for study and clarification. When the proposal arrives, there will be general pandemonium and confusion on your part and your area chief. Many false starts and frustration will become commonplace for several days. However, analysis of the proposal and the approach to be taken will be ironed out. The approach will be indigenous to your own board and will include data collected from government testing conducted by groups such as TECOM, ARI, or other divisions of CHPPM/AEHA. Data from the offeror and the government will be used to rate each offeror. In fact, you will be asked to meet with the testing command to ensure that the sampling method, instrumentation, and environmental conditions are adequate enough to facilitate your evaluation. You will have cooperation on most sampling approaches, but some compromises will have to be made. Hang tough. One board actually attempted to get the industrial hygienist to conduct the tests, but you should strongly discourage these requests.

Figure B-2 relates how one of the SSEBs determined its recommendation. Each area divided its approach into sections of study and emphasis. These sections were rated at each level. Input from MANPRINT was spread out in several of the areas listed on Figure B-2. In order to rate each section, you have to devise evaluation criteria for that particular section (see Figure B-3). For example, one of the sections considered was the impulse noise of a particular offensive system. The hapless SSEB member had to rack his brains to determine criteria to rate the system excellent, very good, good, acceptable, or unacceptable in terms of exposure, protective equipment, engineering controls, and risk assessment. The adjective rating had to have an objective numerical rating also.

SOURCE SELECTION EVALUATION PRIMER

Essentially, you were asked to rate a system objectively through subjective criteria. The system had its imperfections, but was one which achieved its purpose—the SSEB's recommendation. The sections were divided as shown in Figure B-2, and each provided a numerical and adjective rating. Through a preconceived weighting system, scores were "rolled up" on each contractor. Each area achieved a final rating for each contractor, and these scores were passed on to the SSEB chairman. At this stage, the final scores were used to determine the board's recommendation.

The SSEB chairman made his recommendation to the Secretariat of Army Committee (SAC), which was made up of two to four star generals and the Undersecretary of the Army. The SAC may send the recommendation back to the board if it does not approve of how the SSEB determined its choice. If the SAC approves the process, it passes the recommendation to the Secretary of the Army. The Secretary of the Army passes it on to the Congress who will accept it, reject it for their own peculiar reasons, or send it back to the SSEB to continue the nightmare. If Congress accepts it, the contract is awarded (see Figure B-4).

Finally, those of us who have had experience on the board have found them to be interesting, but taxing on time and mental energy. You may be spending days alone in a room pouring over reams of material. You will feel schizophrenic after awhile, because you will find yourself flipping back and forth between the job there and the one here. You may find yourself somewhat estranged at IHD because you will not be as involved in surveys and policy making. Management will lament the loss of your services, and ask you frequently when it will all end.

However, it will provide an opportunity to address potential health hazards before the item(s) are distributed instead of afterwards. The approach and mindset of the SSEBer should be one of prevention. The total experience will not always be fun, but it will be interesting. Should your name be drawn (by God knows who)—Good Luck!

SOURCE SELECTION EVALUATION PRIMER

Source Selection
Evaluation Board
Reference Library

1. American Conference of Governmental Industrial Hygienists, *Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents and Biological Exposure Indices*, Cincinnati, Ohio.
2. AR 40-5, *Health and Environment*.
3. AR 40-10, *Health Hazard Assessment Program in Support of the Army Materiel Acquisition Decision Process*.
4. AR 40-46, *Control of Health Hazards from Lasers and Other High Intensity Optical Sources*.
5. AR 200-1, *Environmental Protection and Enhancement*.
6. AR 200-2, *Environmental Effects of Army Actions*.
7. AR 385-9, *Safety Requirements for Military Lasers*.
8. AR 602-1, *Human Factors Engineering Program*.
9. AR 602-2, *Manpower and Personnel Integration (MAN-PRINT) in the System Acquisition Process*.
10. DA PAM 40-501, *Hearing Conservation*.
11. DODI 6055.1, *Department of Defense Occupational Safety and Health*.
12. DODI 6055.5, *Industrial Hygiene and Occupational Health*.
13. ISO DIS 2631, *International Organization for Standardization, International Standard: Guide to the Evaluation of Human Exposure to Whole Body Vibration* (available from ANSI, Inc. 1430 Broadway, New York, NY 10018; 212/353-3300).
14. MIL-H-46855, *Military Specifications: Human Engineering Requirements for Military Systems, Equipment and Facilities*.
15. MIL-HDBK-759, *Human Factors Engineering Design for Army Materiel*.
16. MIL-STD-882C, *System Safety Program Requirements*.
17. MIL-STD-1472C, *Human Engineering Design Criteria for Military Systems, Equipment and Facilities*.

SOURCE SELECTION EVALUATION PRIMER

18. MIL-STD-1474, *Noise Limits for Army Materiel*.
19. TB MED 81, *Cold Injury*.
20. TB MED 269, *Carbon Monoxide: Symptoms, Etiology, Treatment and Prevention of Overexposure*.
21. TB MED 502, *Respiratory Protection Program*.
22. TB MED 506, *Occupational Vision*.
23. TB MED 507, *Prevention, Treatment and Control of Heat Injury*.
24. TB MED 523, *Control of Hazards to Health from Microwave and Radio Frequency Radiation and Ultrasound*.
25. TB MED 524, *Control of Hazards to Health from Laser Radiation*.
26. 29 CFR 1910, *Occupational Safety and Health Standards*.

■ Source: "Industrial Hygiene Procedures Manual," CHPPM/AEHA, ATTN: MCHB-MI-W, Mr. Tim Williams, Aberdeen Proving Ground, MD 21010-5422 (Mr. Williams is currently with the Chemical and Biological Defense Activity).

**MANPRINT in the Source
Selection Process**

Treatment of MANPRINT

- MANPRINT shall be a separate major area of the same visibility as technical, management, and cost and shall be evaluated throughout all aspects of design, development, integrated logistic support, and program management.
- Treatment of MANPRINT shall be tailored to suit the nature and priorities of the program and contract effort.

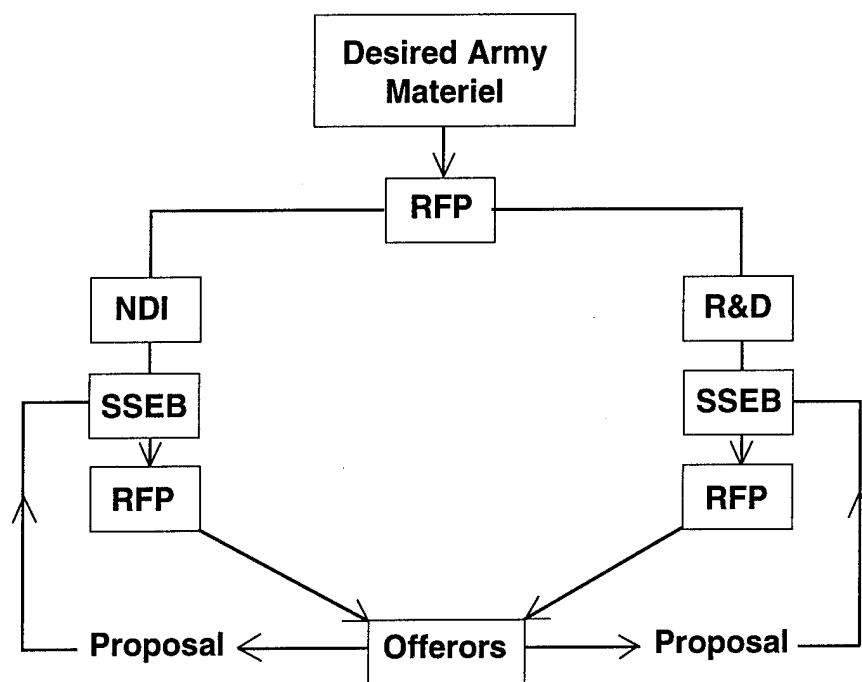
Procedures

- The SOW shall contain appropriate MANPRINT tasks for the contractor to perform and provision for that work shall be made in the contract Work Breakdown Structure.

SOURCE SELECTION EVALUATION PRIMER

- The specifications shall describe how the system is to look and act to the user, and in the quality assurance paragraphs, how those requirements shall be verified.
 - MANPRINT data (i.e., program plans, reports, drawings) to be delivered under the contract shall be included in the CDRL.
 - MANPRINT considerations shall be included in Section L, Instructions to Offerors, and Selection M, Evaluation Factors for Award.
 - MANPRINT considerations shall be included in the SSEB plan.
 - The SSEB shall include experts from all of the operative MANPRINT domains.
-
- *Source: HQDA, Office of the Deputy Chief of Staff for Personnel, MANPRINT Directorate, Revised AR 602-2.*

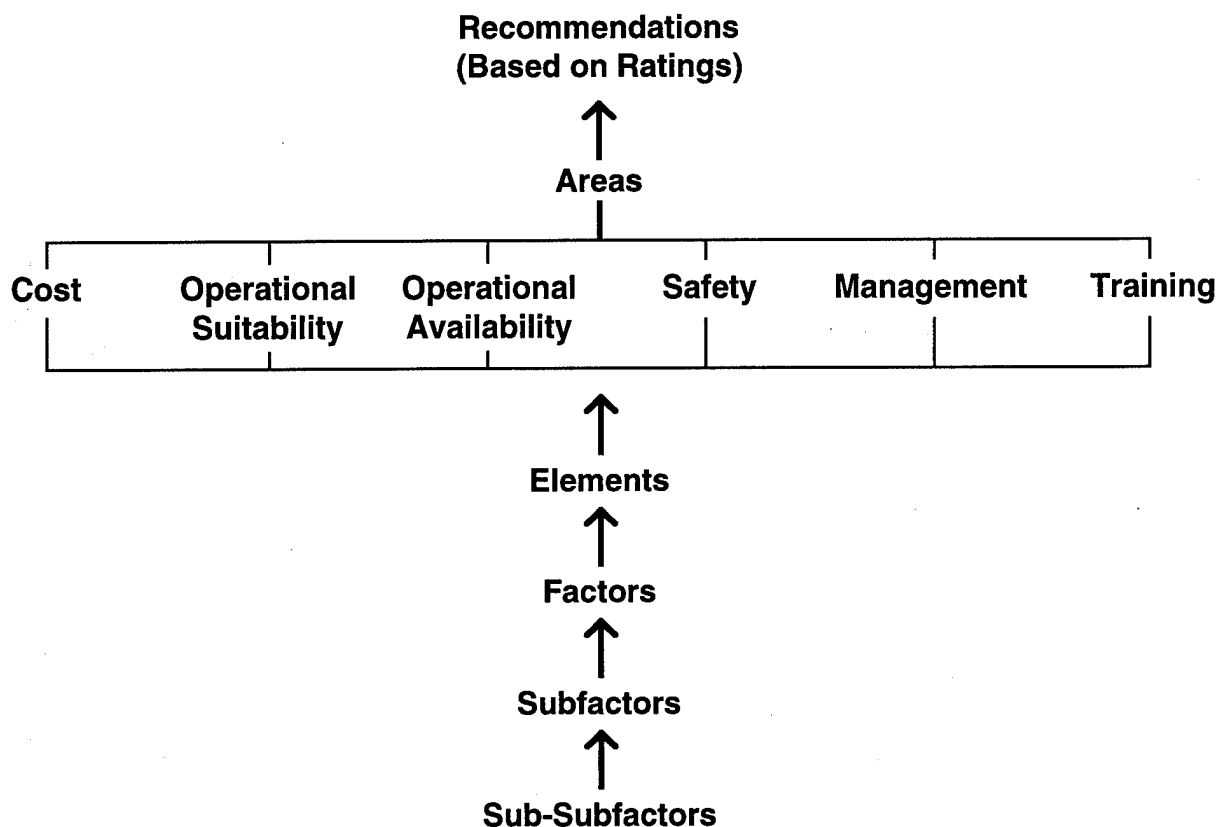
SOURCE SELECTION EVALUATION PRIMER



RFP request for proposal
NDI nondevelopment items
R&D research and development
SSEB Source Selection Evaluation Board

Figure B-1. Diagram of SSEB role in acquisition of Army materiel process

SOURCE SELECTION EVALUATION PRIMER



Example for the area of operational suitability

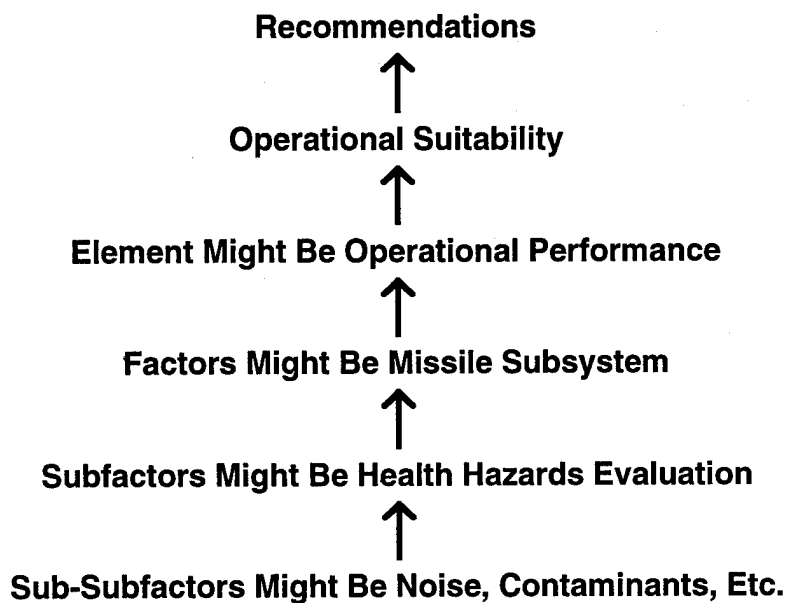
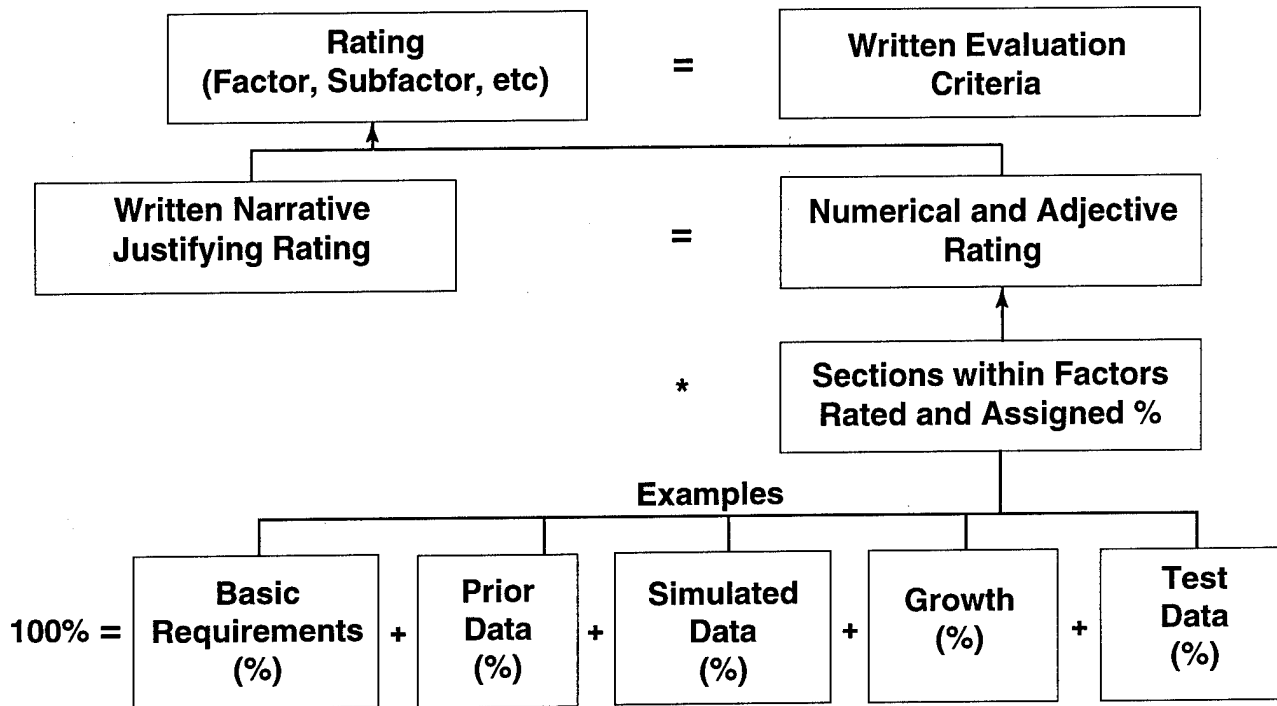


Figure B-2. SSEB recommendation flow chart

SOURCE SELECTION EVALUATION PRIMER



* These can change throughout the life of the SSEB.

OVERALL RATINGS

Excellent	Very Good	Good	Acceptable
90-100%	80-89%	70-79%	60-69%

Figure B-3. Rating flow chart

SOURCE SELECTION EVALUATION PRIMER

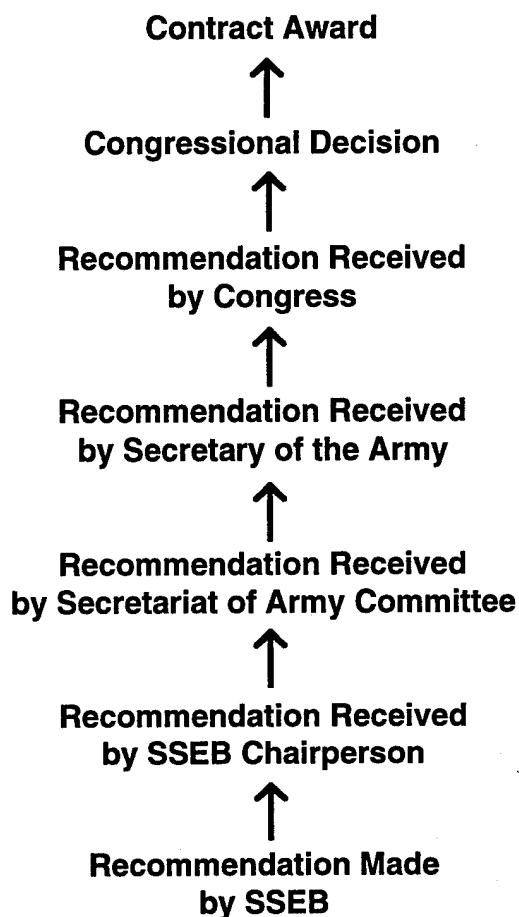


Figure B-4. Contract award process

SOURCE SELECTION EVALUATION PRIMER

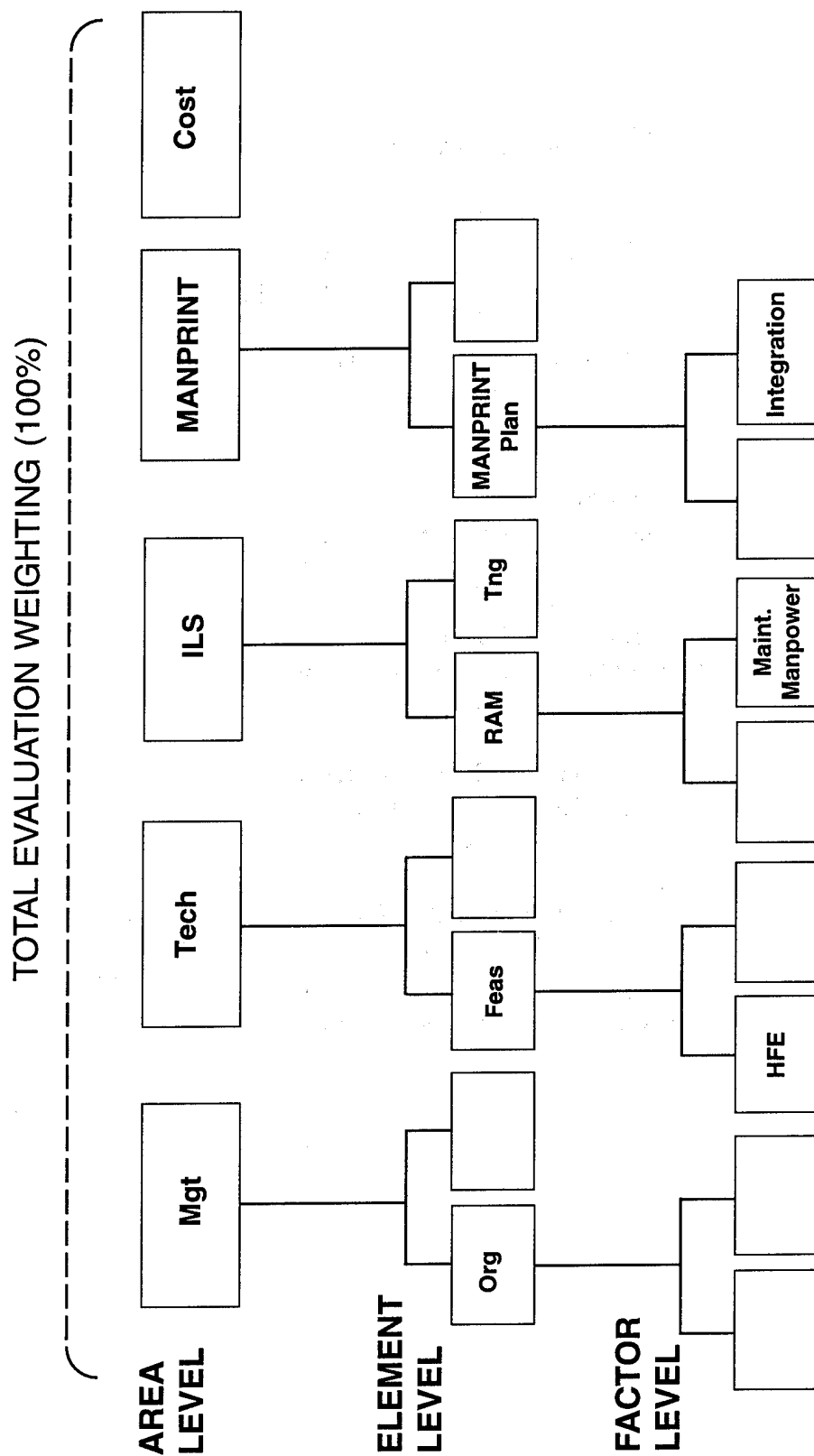


Figure B-5. MANPRINT in source selection evaluation

APPENDIX C

Health Hazard Assessment Fact Sheet

■ This appendix:

- Provides a synopsis of the HHA report process with methods for control of the following hazards:
 - Toxic chemical.
 - Physical.
 - Biological.
- May be used as an informational tool.

HEALTH HAZARD ASSESSMENT FACT SHEET

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HEALTH HAZARD ASSESSMENT FACT SHEET

Purpose

The Army's Health Hazard Assessment (HHA) program is designed to identify and eliminate or control health hazards associated with the life cycle management (LCM) of new materiel systems. Medical personnel assess the health hazards inherent to or resulting from the operation and maintenance of materiel systems. The HHA program focuses on potential health hazards resulting from training and combat scenarios; however, health hazard issues in any phase of the LCM may be addressed. The results of this assessment are documented in a formal HHA report. This document is used to provide developers, testers, evaluators, and users of new materiel an analysis and assessment of health hazard issues.

Hazard Identification

The first step in the HHA process is to identify potential health hazards. Hazard identification consists of analyzing specific chemical, physical, or biological agents associated with the operation and maintenance tasks of a new system. To aid in the identification of health hazards, the medical assessor uses experience from:

- Previous systems
- Safety assessments
- Human factor assessments
- Operational requirement documents
- Management documents
- Test documents
- User manuals
- Field observations

Exposure Assessment

The exposure assessment is fundamental to the evaluation process. The medical assessor needs to review the information available on the:

- Levels of the specific agents
- Potential routes of exposure
- Duration of exposure
- Frequency of exposure
- Population at risk

Exposure levels can be determined by direct readings of actual environmental conditions during training or simulated combat situations. This data would be collected during user or technical testing by the developer. In some unusual cases,

the medical assessors may need to collect their own data. For some applications, modeling techniques can yield useful potential exposure data at less cost and in less time than actual monitoring.

The routes of exposure include air, skin, water, and food. Each of the potential hazardous agents needs to be analyzed with respect to how they may impact human health. The duration of exposure and frequency will be determined by the intended use of the system and how soldiers are trained to use the system.

Exposure assessments are a key to the HHA process. An evaluation of the routes, magnitude, frequency, and duration of exposure must be made to complete the HHA process. In those cases when critical data are not available or incomplete, a professional judgment or inference based on the assessor's experience and reasoning may be necessary.

Hazard Assessment

Hazard assessment combines the exposure assessment and the identification information to evaluate the extent of the health hazards. The exposure estimates are compared with established health criteria to assess the significance of the hazards. The goal of the HHA program is to identify potential hazards early in the life cycle and design the hazards out of the system. When health hazards cannot be eliminated, estimates of health risk severity and probability are made in order to characterize the uncontrolled hazard with a risk assessment code (RAC). The RAC procedure is adopted from MIL-STD 882 and is used to quantify health risks to personnel who will be operating or maintaining Army systems during testing, training, or combat.

Control Recommendations

The medical assessor provides recommendations for the elimination or control of identified health hazards. RAC codes are assigned to uncontrolled health hazards to aid in the prioritization of control actions. The following is a summary of the actions that can be used to eliminate, reduce, or control health hazards associated with the operation and maintenance of Army systems.

■ *For more information on the Army's HHA services, contact:*

U.S. Army Center for Health Promotion and Preventive Medicine
U.S. Army Environmental Hygiene Agency
ATTN: MCHB-MO-A
Aberdeen Proving Ground, MD
21010-5422
DSN 584-2925; 410/671-2925

Methods for Control of Toxic Chemical/Physical/Biological Hazards* in Human Environments

1. **Elimination** of the toxic substance, hazardous condition, biological agent, or of the source, e.g., use of alternate fuels to eliminate sulfur.
 2. **Substitution** of a less toxic substance, e.g., toluene for benzene, glass fiber for asbestos fiber in thermal insulation, or use of Rule 66 solvents.
 3. **Isolation**. Use of distance or shielding, e.g., as in hot cells controls for radioactive materials or barriers and restricted access to carcinogenic or biohazardous operations.
 4. **Enclosure**. Totally enclose, as in a glove box, or partially, as in a booth or hood.
 5. **Ventilation**. General dilution or local exhaust; local exhaust system components will include: hood, enclosure, or extraction connection at the source; ductwork; industrial air and gas cleaning device; air moving device; stack or ducted outlet. May also include ancillary systems or functions for operation, control, recirculation of exhaust, and waste disposal.
 6. **Process change**. Use of change in manufacturing method or machine, or process, or operation to reduce or eliminate hazard; soft energy technologies; closed system vs. open kettle operation.
 7. **Product change**. Process research to reduce benzene yield in petroleum refining; reduced free vinyl chloride content of polyvinyl-chloride.
 8. **Housekeeping**. Keep all surfaces clean of contaminants as in biologic, radiologic, or chemical carcinogen hazard control to prevent their redispersion or to eliminate personal contacts.
 9. **Dust suppression**. Wet down dusty sources, wet drilling, and use of soil, stock, or waste pile stabilizers, windbreaks, etc.
 10. **Maintenance**. Continued maintenance of effective control system performances, as well as of process, operational, or manufacturing equipment, to reduce or eliminate inadvertent releases of hazardous materials.
 11. **Sanitation**. Use of hygienic principles to reduce or eliminate hazardous materials from the person, as with clothing changes, shower-in or shower-out, sterilization, chlorination, and pasteurization.
 12. **Work practices**. Specification of proper work practices to reduce or control release, dissemination, or inadvertent exposure to hazardous substances or conditions.
 13. **Education**. Educate worker, management, and the public to the nature of a hazard and how properly to minimize risk; most importantly, education of engineers to discover, develop and design products, processes, and systems with minimum hazard to workers or users.
 14. **Labeling and warning systems**. Use in conjunction with other methods, e.g., education.
 15. **Personal protective equipment**. Use where other control methods are not technically or economically feasible, e.g., use of respiratory protective devices include: head protection; ear protection; eye protection; respiratory protective devices; hand and arm protection; trunk, body, or apron-type protection; lower torso, thigh, leg protection; foot protective devices.
 16. **Environmental monitoring**. Use of inter-mittent or continuous atmospheric sampling and analysis methods for the hazard by area sampling, personal sampling, or process or duct sampling; each type used to determine characteristics of the emission, level of human exposure, or operational condition.
 17. **Waste disposal practices**. To reduce or eliminate redistribution of discharged contaminant or process waste streams to other receptors, including solid waste disposal in effective incinerators or landfills, liquid waste disposal to appropriate treatment and dilution, and atmospheric dilution and dispersion of gases or vapors after effective removal of contaminants, e.g., as in disposal of asbestos wastes, sulfur oxide scrubber sludges, or stack gas discharges.
 18. **Administrative control**. Reduction of time of exposure of receptor to the contaminant, as in supplement control strategies by the use of fuel switching to reduce sulfur oxide emissions or use of annual accumulated radiation dose of 5 REM/yr for worker and removal from exposure when exceeded; may include plant location or siting and plant layout.
 19. **Medical control**. To reduce or eliminate effects of human exposure to hazardous substances, conditions, or agents through medical surveillance; methods include: pre-placement screening to restrict high-risk persons, biologic monitoring (e.g., for lead in blood), medical removal, medical exclusion, general reviews and treatment.
 20. **Management program**. Formal organization with authority and responsibility to provide control program activities; plan, organize, implement, control.
- *Hazard implies an estimate or risk of the probability that an unwanted event will occur of a given severity or magnitude. It is a function of toxicity (an intrinsic property of materials in biologic systems) and dose (exposure level of concentration at the site of toxic action and time of exposure). Each of the control methods listed can usually be shown to reduce or eliminate the toxicity or the dose and thereby the hazard or risk. "A thing is considered to be safe if its risks are judged to be acceptable."
- Source: Archives of Environmental Health.

APPENDIX D

MANPRINT Process and the System Management MANPRINT Plan

■ This appendix:

- Provides some background information on the System Management MANPRINT Plan (SMMP) and the required format for the SMMP.
- Is to be used by personnel who participate in MANPRINT Joint Working Groups and/or may have to input health hazard issues into the SMMP.
- Provides the format for the missions needs statement (MNS) and the operational requirements document (ORD).
Shows how SMMP issues are crosswalked into these two documents.
- Shows how SMMP issues are integrated in the test and evaluation process.
- Shows how the SMMP is integrated in the contract solicitation process.
- Shows how SMMP issues and the ORD are crosswalked in the request for proposal (RFP).

Health hazard issues and pollution prevention issues follow the same path as described in this appendix. It should be noted that the MNS, once approved, starts the materiel acquisition process. MANPRINT considerations and constraints should be included in the MNS. For more detailed information on MANPRINT, refer to AR 602-2, Manpower and Personnel Integration (MANPRINT) in the System Acquisition Process.

■ *Source: HQDA, DCSPER, ATTN: DAPE-MRA, Briefing Charts, and AR 602-2, Manpower and Personnel Integration (MANPRINT) in the System Acquisition Process.*

MANPRINT PROCESS AND THE SYSTEM MANAGEMENT MANPRINT PLAN (SMMP)

Introduction

1. The SMMP is a planning and management tool that outlines and documents the MANPRINT management approach, associated decision and planning efforts, user concerns, and resolution of MANPRINT issues during system acquisition. Identification and documentation of these issues early in the acquisition cycle increases the probability of their resolution, thereby enhancing total system performance, affordability, supportability, and conservation of the Army's resources.
2. The SMMP is the cornerstone of the MANPRINT effort to ensure human considerations are effectively integrated into the development and acquisition of Army systems.
 - a. The SMMP enhances and documents the Army's effort to focus on total system performance. Consequently, goals to optimize total system performance and reduce the cost of ownership must consider the military and civilian personnel operating, maintaining, training, and supporting systems.
 - b. The SMMP serves as a record of the continuous evolution of a system. At a minimum, it provides a status update prior to each Milestone Decision Review (MDR). Specifically, objectives for the system's human element that are established at Milestone I and are traceable to readiness, force structure, affordability, and wartime operational objectives must be updated at successive milestone decision points.
 - c. The SMMP documents the MANPRINT issues that arise during the acquisition of a system and contains the plans and schedule of MANPRINT activities to resolve these issues and any subsequent issues identified during a system's life cycle. The data bases and analyses that may provide answers for MANPRINT issues are also identified in the SMMP along with references to other MANPRINT data sources.
 - d. Information contained in the SMMP "feeds" other documents (e.g., ORD, Functional Description (FD), TEMP,

MANPRINT PROCESS AND THE SYSTEM MANAGEMENT MANPRINT PLAN (SMMP)

RFP). Likewise, new MANPRINT information contained in other documents will "feed" the SMMP.

Preparation

1. The SMMP is initiated upon approval of an MNS and initiation of an ORD.
2. The SMMP shall contain the information in the following section on the SMMP's required format.
3. A SMMP shall be prepared for each developmental, nondevelopmental, and materiel change (product improved) system.
4. For materiel systems, the SMMP shall be submitted by the combat developer (CBTDEV) to HQ TRADOC and the program sponsor for joint approval. Copies of the approved SMMP shall be provided to those organizations and/or agencies participating in the MJWG. Copies of the approved SMMP shall be furnished to HQDA ODCSPER (DAPE-MR), PERSCOM (DCSPLANS), ARL-HRED, and CHPPM/AEHA.
5. For major automated information systems (MAIS), the SMMP shall be jointly approved by the functional proponent (CBTDEV, where appropriate) and the PM. For nonmajor AIS, the SMMP shall be jointly approved by the functional proponent (CBTDEV, where appropriate) and Information Systems Command (ISC). Copies of the approved SMMP shall be furnished to HQDA ODCSPER (DAPE-MR), PERSCOM (DCSPLANS), ARL-HRED, and CHPPM/AEHA.
6. For clothing and individual equipment (CIE) systems being acquired, the need for a SMMP shall be determined by CG, AMC. If required, the SMMP shall be prepared by the CBTDEV and forwarded to HQ TRADOC and the PM for joint approval. Copies of the approved SMMP shall be furnished to HQDA ODCSPER (DAPE-MR), PERSCOM (DCSPLANS), ARL-HRED, and CHPPM/AEHA.

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MANPRINT PROCESS AND THE SYSTEM MANAGEMENT MANPRINT PLAN (SMMP)

Required Format

Element 1: Title/Approval Page

1. Purpose. The Title/Approval Page documents the name of the system, milestone, and approval status.
2. Content. Provide this statement, appropriately completed: "System MANPRINT Management Plan for (name of the system) in support of Milestone # ____." The approving officials, prior to each MDR, shall sign and date this page.

Element 2: Abbreviated Total System Description

1. Purpose. Element 2 identifies the system type, operational environment, and the target audience.
2. Content.
 - a. Subelement 1–System Description.
 - Indicate system type (combat, combat support, combat service support, AIS, or CIE) and provide an abbreviated system description with emphasis on human interfaces.
 - Describe the operational environment in which the system will be operated, maintained, repaired, trained, and supported.
 - b. Subelement 2–Target Audience Description.

Identify by Military Occupational Specialty, Area of Concentration and/or Occupational Identifiers (e.g., Office of Personnel management job series and grade, the personnel projected to operate, maintain, repair, train, and support the system) and list the information sources that can describe these personnel. For each occupational identification, provide the quantities needed.

Element 3: Acquisition Strategy

1. Purpose. Element 3 indicates acquisition category and, when known, type of acquisition strategy.

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MANPRINT PROCESS AND THE SYSTEM MANAGEMENT MANPRINT PLAN (SMMP)

2. Content. Provide program category as defined in DODI 5000.2, Part 2 (materiel systems) and DODI 8120.2 (AIS). For materiel systems, indicate type of acquisition strategy (developmental, nondevelopmental, or materiel change). AIS acquisition strategies include grand design program strategy, incremental program strategy, and evolutionary program strategy.

Element 4: Deficiencies and/or Lessons Learned of the Predecessor Reference System

1. Purpose. Element 4 identifies any predecessor or reference system, identifies lessons learned from that system, and outlines applicability of lessons learned to the new system.
2. Content. List deficiencies and/or lessons learned from predecessor/reference systems by MANPRINT domain. Summarize applicability of lessons learned to the new system. Consider each component of the system to include training devices and repair and support equipment. If the new system has no direct predecessor, reference components of various systems may be used.

Element 5: MANPRINT Parameters

1. Purpose. Element 5 identifies MANPRINT goals or objectives (desired outcomes) and constraints (boundaries that cannot be exceeded), based on guidance and assumptions in Element 2.
2. Content. Determine and state system objectives and operational/affordability constraints within the context of MANPRINT goals as identified by the MJWG. The objectives and minimum acceptable requirements will become progressively more numerous and more detailed at successive milestone decision points and at successive updates of the SMMP.

Element 6: MANPRINT Issues

1. Purpose. This element identifies MANPRINT issues and provides a brief statement of the issue, affected domains, responsible agency, data source and projected availability, findings, and status. MANPRINT issues that arise later in system development are treated in the same manner and are documented in this element. Avoid listing the issues in domain sequence to minimize redundancy and enhance emphasis on the integration process. Start with a summary listing showing the issues with status indicators and date of initial or latest actions. Write the issues in human performance terms, if possible, or—at a minimum—write the issues so the status is clear and concise.
2. Content. For each issue, provide information requested under the following headings:
 - a. Statement of Issue.
 - b. Affected Domains.
 - c. Responsible Agency.
 - d. Data Source and Projected Availability.
 - e. Findings.
 - f. Status.

Element 7: MANPRINT Execution

1. Purpose. Element 7 documents execution of the system MANPRINT program throughout the acquisition phases. During the Concept Exploration and Definition phase, MANPRINT execution impacts requirements, contractual, and test and evaluation documents. Subsequent acquisition phases involve executing plans to achieve MANPRINT goals, to implement solutions to potential problems associated with MANPRINT constraints, to resolve any additional MANPRINT questions that emerge during system development/acquisition.

MANPRINT PROCESS AND THE SYSTEM MANAGEMENT MANPRINT PLAN (SMMP)

2. Content. Provide a time-phased description of how the MANPRINT program will be executed in each acquisition phase. Identify the lead agencies. Identify the MANPRINT activities to be accomplished by each domain.

Element 8: Coordination

1. Purpose. Element 8 is a listing of organizations with whom the SMMP was coordinated. This list should contain organizations receiving a staffed copy of the SMMP for information purposes only.
2. Content. Include name, organization, office symbol, and telephone number of the POC.

MANPRINT PROCESS AND THE SYSTEM MANAGEMENT MANPRINT PLAN (SMMP)

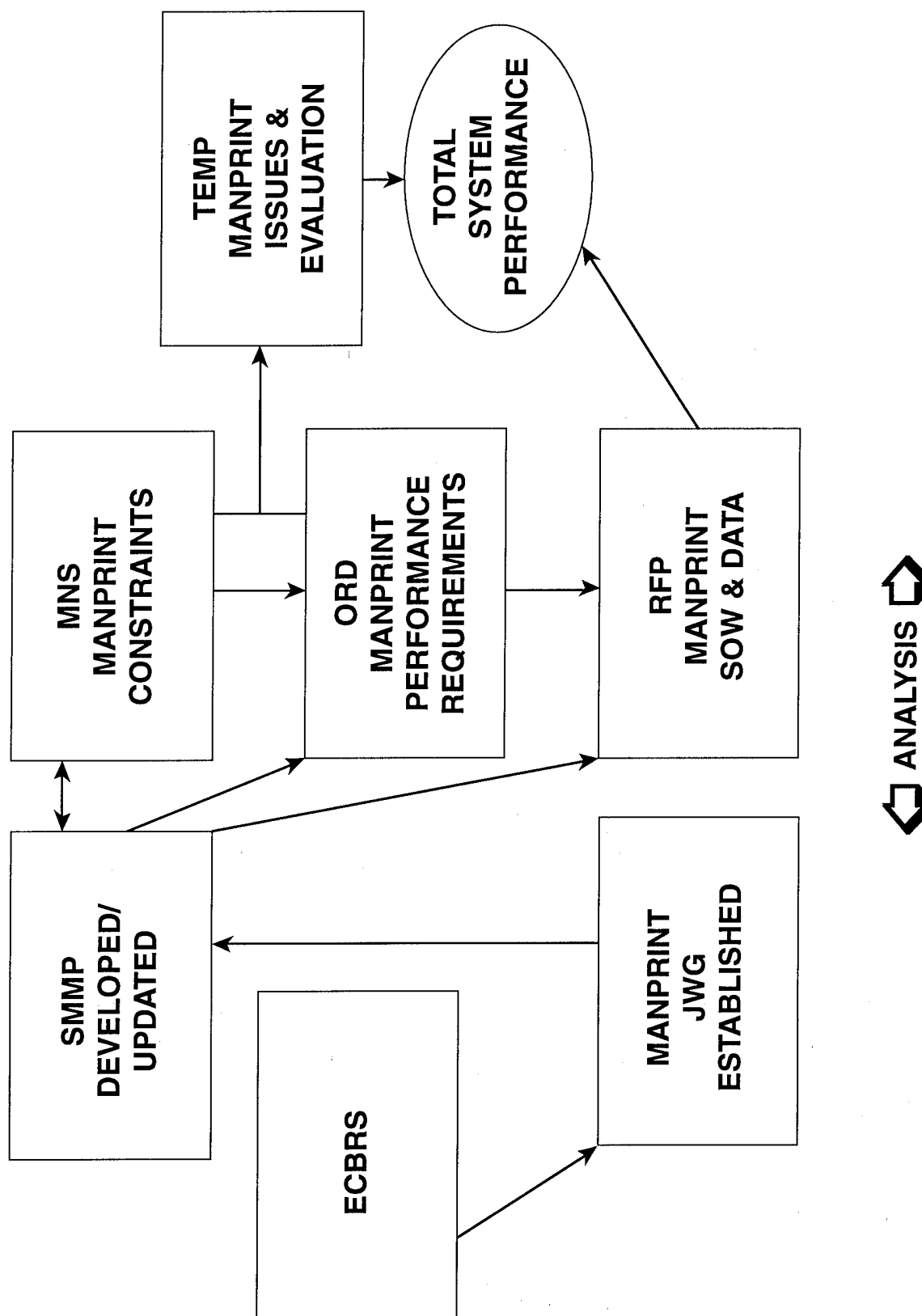


Figure D-1. The MANPRINT process

**MISSION NEED STATEMENT
FOR
TITLE OF OPERATIONAL CAPABILITY NEED**

1. Defense Planning Guidance Element
2. Mission and Threat Analysis
3. Nonmateriel Alternatives
4. Potential Materiel Alternatives
5. Constraints

Figure D-2. Mission need statement (format)

**OPERATIONAL REQUIREMENTS DOCUMENT
FOR
PROGRAM TITLE**

1. General Description of Operational Capability
2. Threat
3. Shortcomings of Existing System
4. Capabilities Required
 - a. System Performance
 - b. Logistics and Readiness
 - c. Critical System Characteristics
5. Integrated Logistic Support
 - a. Maintenance Planning
 - b. Support Equipment
 - c. Human Systems Integration
 - d. Computer Resources
 - e. Other Logistics Considerations
6. Infrastructure Support and Interoperability
 - a. Command, Control, Communications, and Intelligence
 - b. Transportation and Basing
 - c. Standardization, Interoperability, and Commonality
 - d. Mapping, Charting, and Geodesy Support
 - e. Environmental Support
7. Force Structure
8. Schedule Considerations

Figure D-3. Operational requirements document (format)

MANPRINT PROCESS AND THE SYSTEM MANAGEMENT MANPRINT PLAN (SMMP)

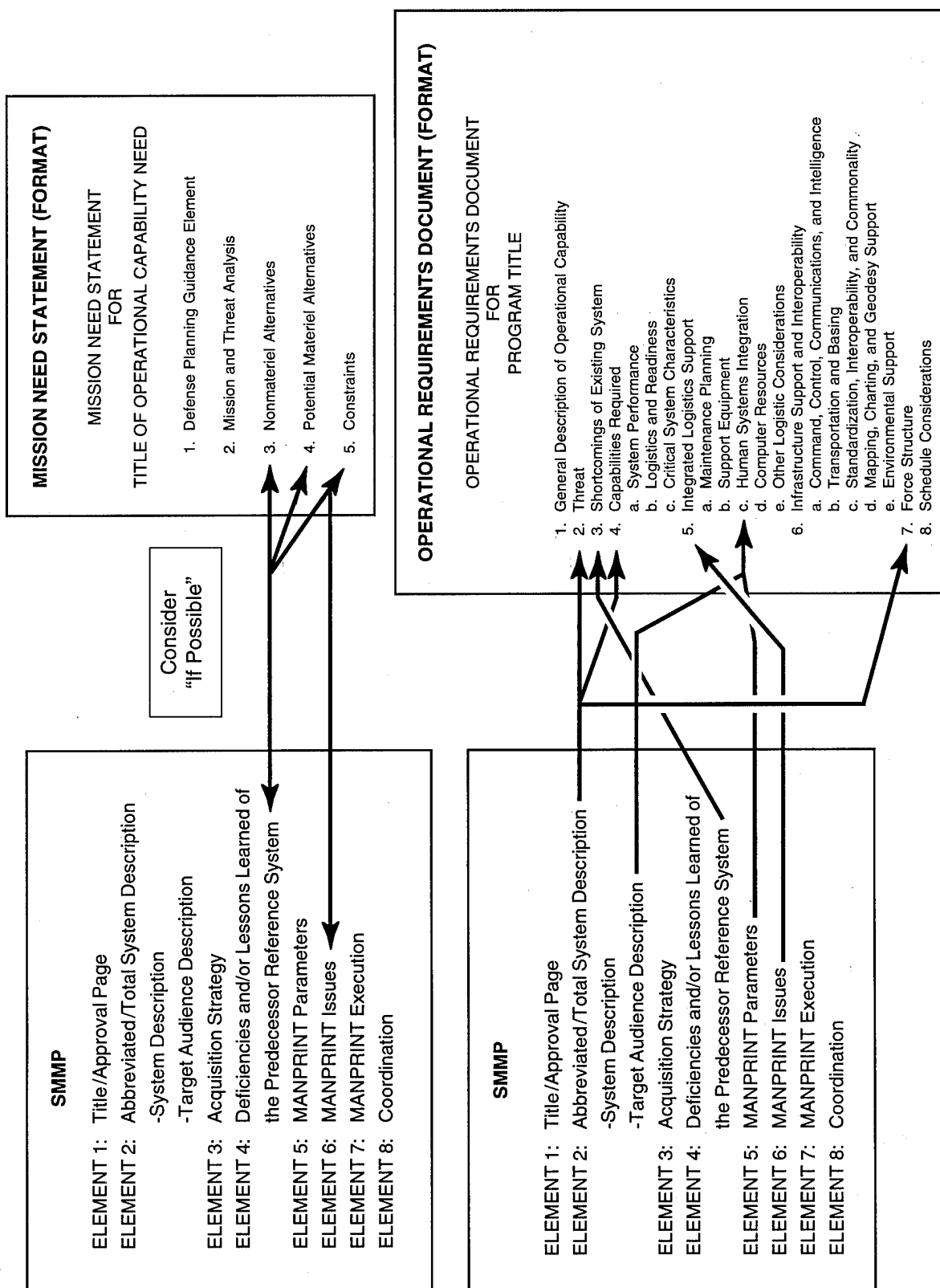


Figure D-4. SMMP to requirement documents crosswalk

U. S. ARMY HEALTH HAZARD ASSESSMENT MANUAL

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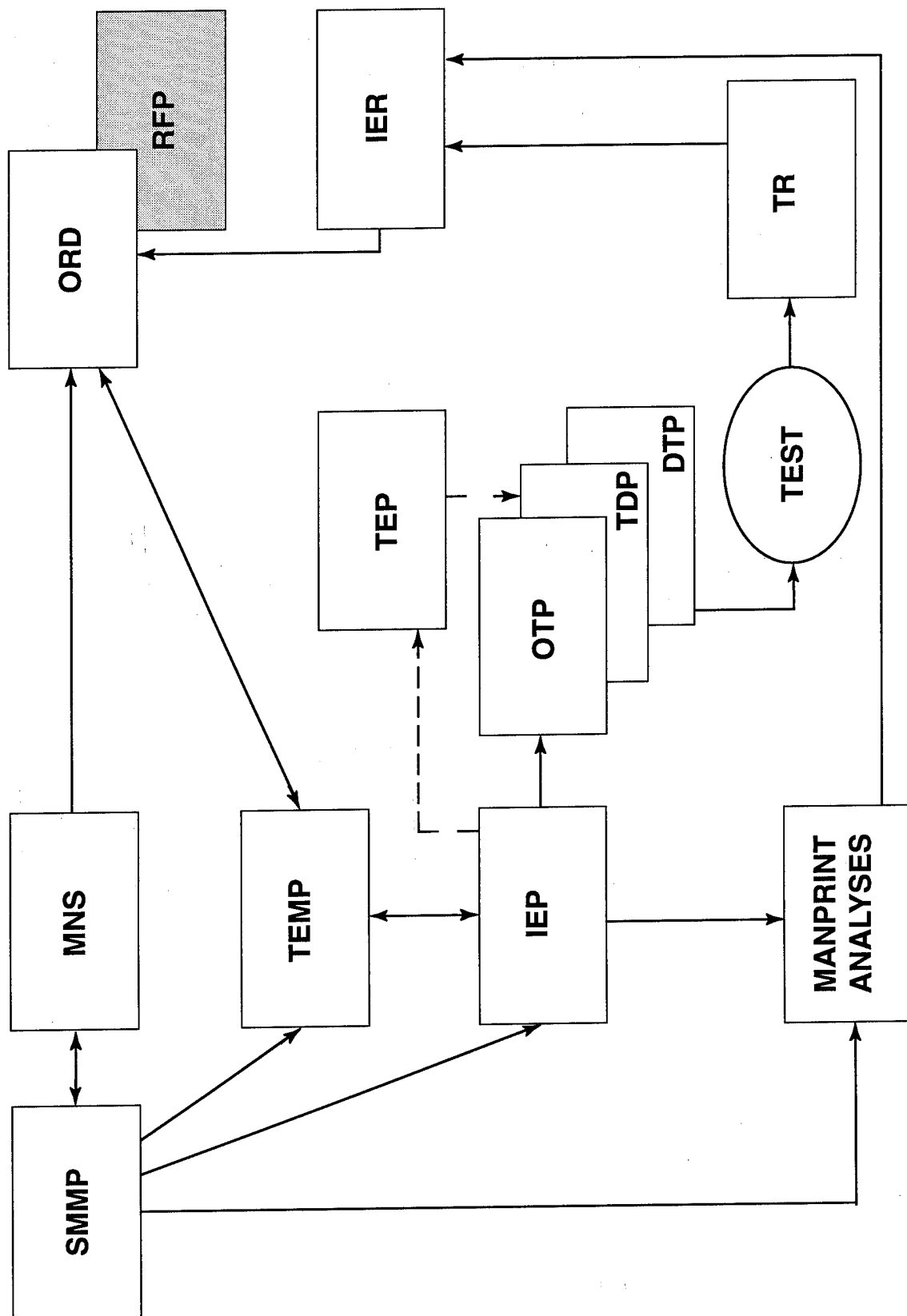


Figure D-5. MANPRINT integration in the test and evaluation process

MANPRINT PROCESS AND THE SYSTEM MANAGEMENT MANPRINT PLAN (SMMP)

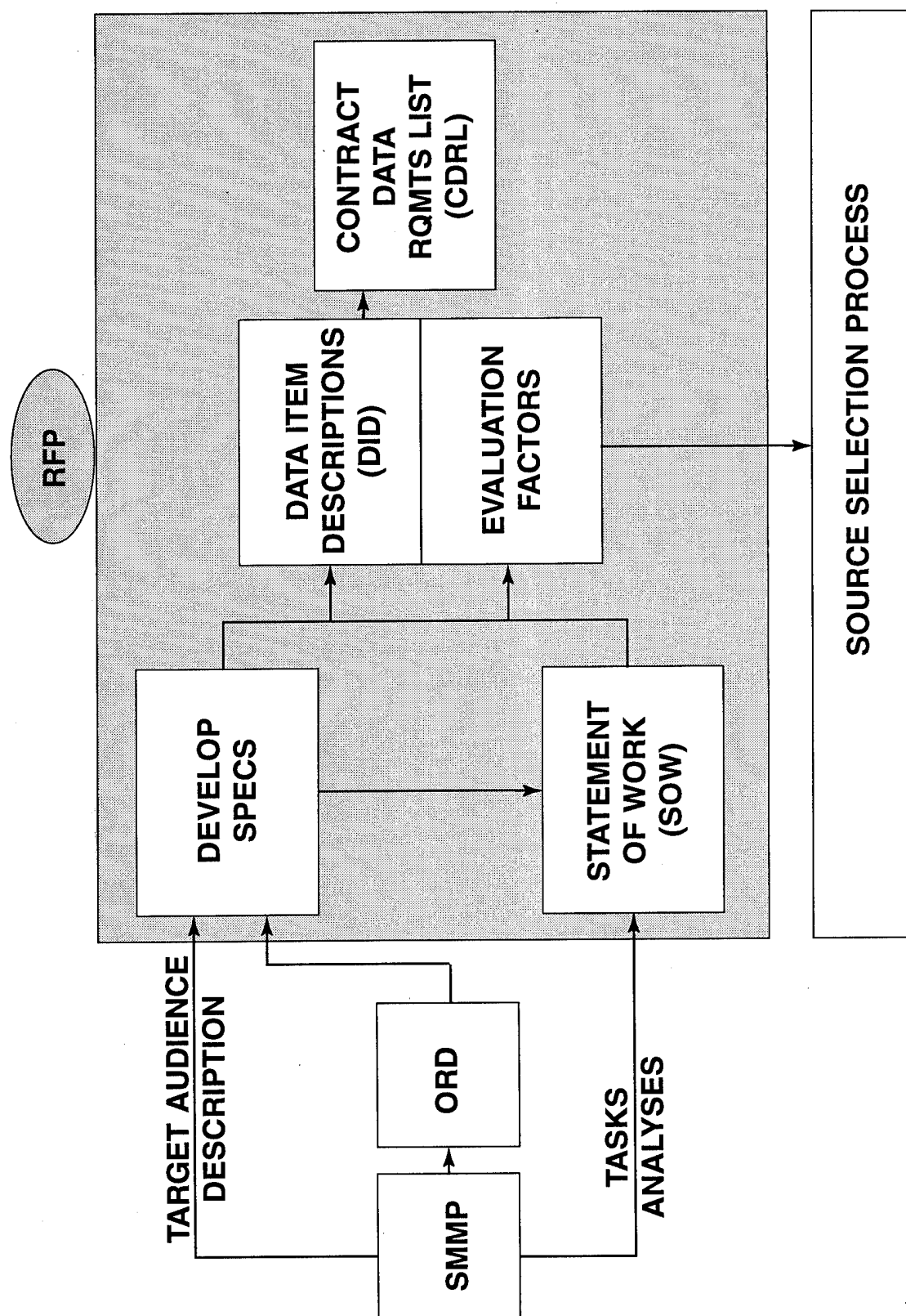


Figure D-6. MANPRINT and solicitations

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MANPRINT PROCESS AND THE SYSTEM MANAGEMENT MANPRINT PLAN (SMMP)

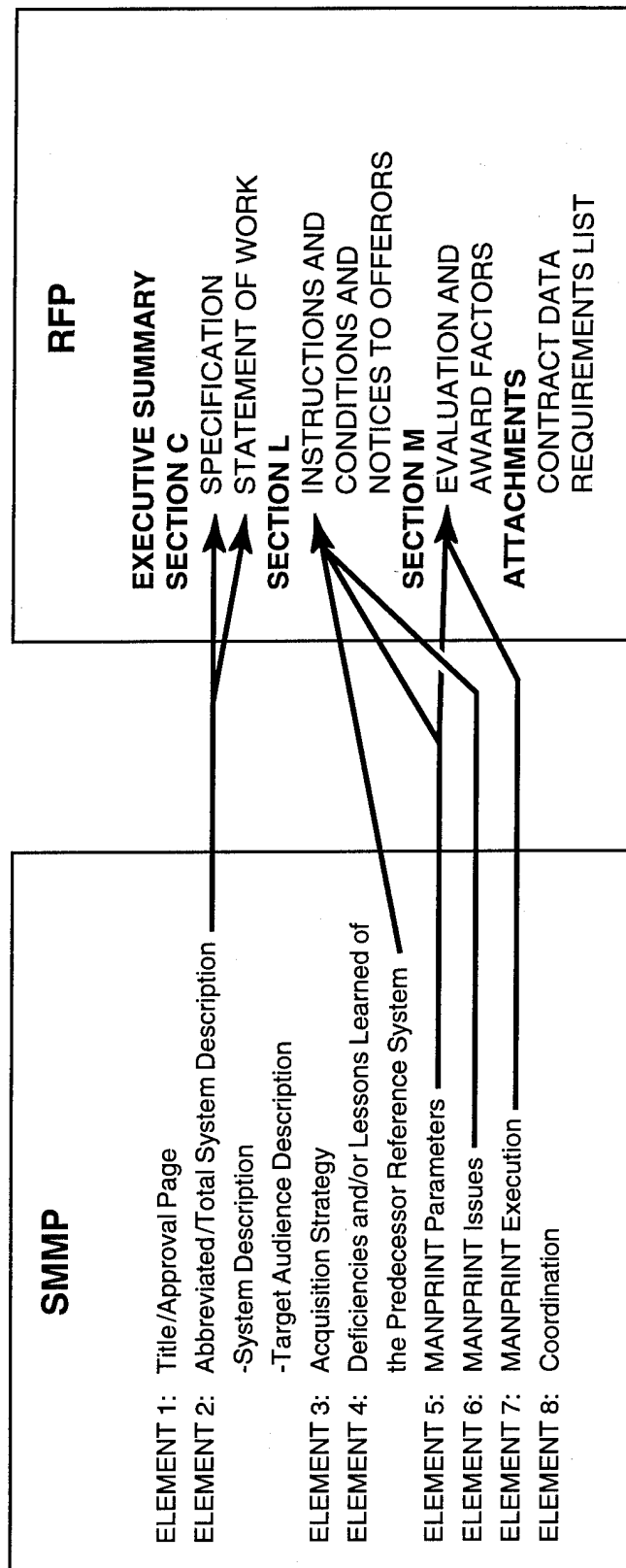


Figure D-7. SMMP/RFP crosswalk

MANPRINT PROCESS AND THE SYSTEM MANAGEMENT MANPRINT PLAN (SMMP)

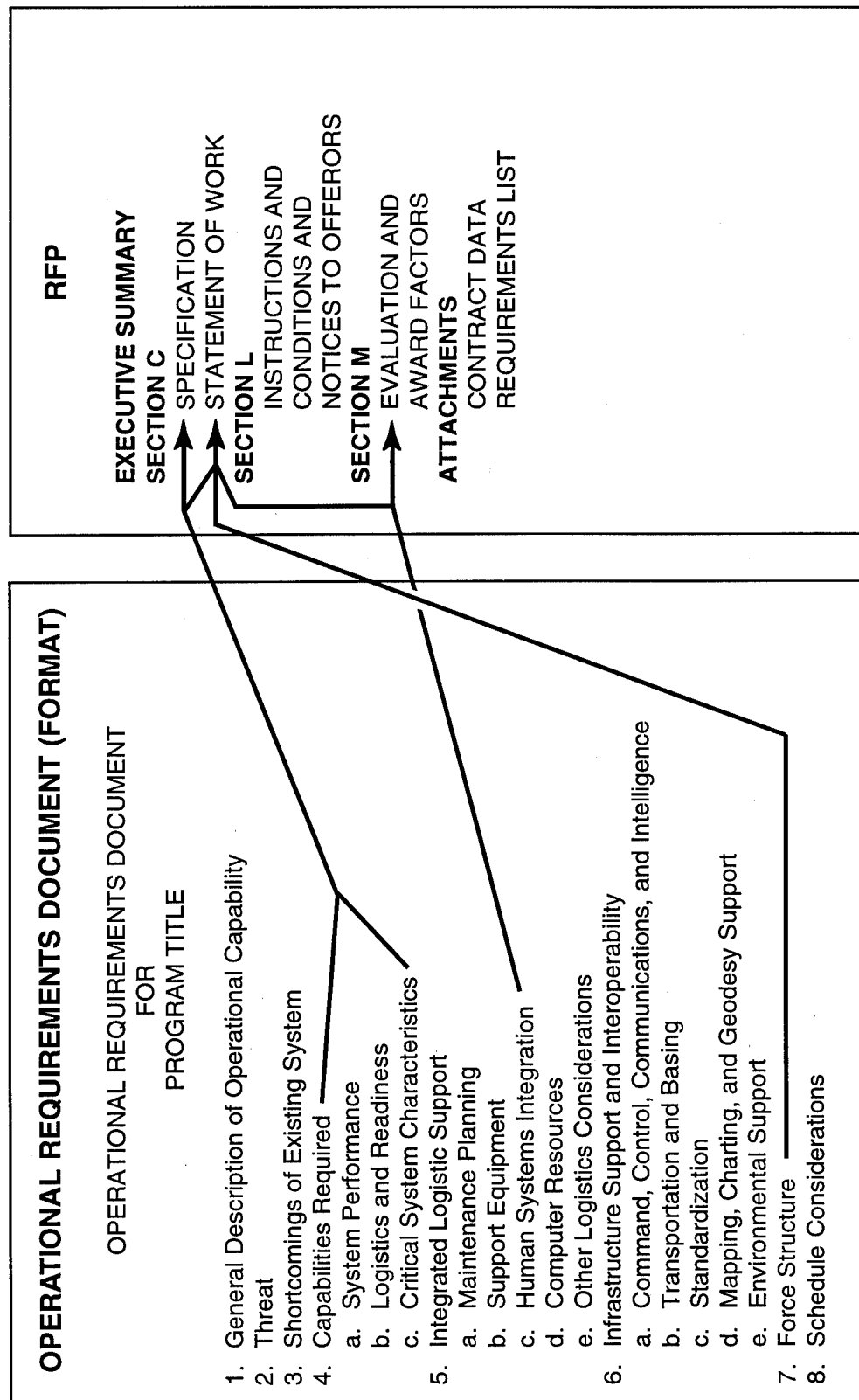


Figure D-8. Operational requirements document (Format)/RFP Crosswalk

HUMAN PERFORMANCE GUIDELINES:

- Soldier Performance Affects System Performance;
- Skill is a Function of Aptitude and Training
- Measure Soldier Performance by Time and Accuracy;
- Equipment Design Determines Soldier Tasks; and
- Make the Designer Responsible for Soldier Performance.

Figure D-9. MANPRINT RFP rules

APPENDIX E

Health Hazard Assessment Procedures in the Acquisition Life Cycle

■ This appendix:

- Briefly explains HHA procedures throughout the acquisition life cycle.
- Describes the health hazard requirements that should be addressed by combat and system developers. Health hazard and pollution prevention emphasis should come early in the process. It is easier to design a problem out than it is to have to apply retrofit measures.
- Contains a draft concept chart with identified responsibilities for early involvement, as well as a flow chart for an initial HHA report.

Purpose

This appendix describes essential procedures for implementing DOD and DA policy guidance for identification, assessment, and elimination or control of health hazards associated with materiel acquisition programs. It explains the types of health hazard assessment (HHA) support available, the mechanisms for requesting HHA support, and the application of HHA information in the acquisition program.

General Discussion

HHAs are required throughout the acquisition life cycle including product improvements and programs for both developmental

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HEALTH HAZARD ASSESSMENT PROCEDURES IN THE ACQUISITION LIFE CYCLE

and nondevelopmental items. (See Figure E-1 for the Life Cycle System Management Model Overview.) The primary mechanism for accomplishing an HHA is the HHA report (HHAR). This document provides a standard structure and approach for assessing system generated threats to the health of soldiers and DOD personnel. HHARs support preparation of MANPRINT Assessment, System MANPRINT Management Plans (SMMPs), Test and Evaluation Master Plans (TEMP), Detailed Test Plans, Market Investigations (MI), Safety Releases, and system technical and training publications. In addition, HHARs provide the materiel developer/combat developer (MATDEV/CBTDEV) with guidance on methods to mitigate system-specific health hazards. See Figures E-2 and E-3 for a concept for improving early systems health hazards involvement.

The objectives of addressing health hazards during RDT&E are to be:

- Sound stewards of our human resources.
- Preserve and protect the health of soldiers and DOD personnel.
- Reduce degradation of soldier's performance and system's effectiveness.
- Enhance system design by eliminating health hazard-related retrofits.
- Reduce health hazard-related training and operational restrictions which compromise readiness.
- Reduce compensation claims.

Systems health hazards issues must receive attention throughout all phases of an acquisition program. However, early consideration of health hazard issues will avoid program delays and costly design modifications. (See Figures E-4, E-5, and E-6 for graphic representations of "why we need to get involved early.")

Health hazard issues are first included in the SMMP. The Initial HHAR (IHHAR) examines lessons learned on predecessor or similar systems, and commonly establishes health hazard data requirements for inclusion in the TEMP and Detailed Test Plans.

HEALTH HAZARD ASSESSMENT PROCEDURES IN THE ACQUISITION LIFE CYCLE

Subsequent HHARs evaluate health hazard data, recommend methods to eliminate or control exposures, and establish the risk of noncompliance. Multiple updated HHARs may be prepared as data become available.

Medical research to support HHAs may be necessary if a system has a hazard for which there is no existing health standard (e.g., liquid gun propellant). Early identification of biomedical data base voids is important, since generating data may require considerable time. Required medical research must be developed parallel to materiel.

CBTDEVs and MATDEVs are responsible for providing reimbursement for all onsite HHA support as requested through command channels, and for HHA medical research related to materiel and operational specific, military unique health effects. The U.S. Army Medical Research Materiel Command (MRMC) will plan, program, budget, and execute medical RDT&E tasks to include development of biomedical data bases and protection criteria for military specific hazards, especially for those exposures that are common to many weapon systems.

Procedures

HHA support organizations and procedures vary with the type of support required and the acquisition phase.

Technology Base Activities. The MRMC conducts basic biomedical research keyed to the Science and Technology Objectives of the Army Technology Base Master Plan through its subordinate laboratories. The MRMC establishes technology base research requirements in coordination with developers. A medical research plan which describes the expected contributions of the MRMC technology based to identified requirements is presented to the developer in coordination with appropriate Medical Command elements.

Requirement Generation. Health hazard constraints are identified in Mission Need Statements (MNSs), Operational

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HEALTH HAZARD ASSESSMENT PROCEDURES IN THE ACQUISITION LIFE CYCLE

Requirements Documents (ORDs), and SMMPs. This support is provided by both the Army Medical Department Center and School and Preventive Medicine Activities colocated with TRADOC schools and integrating centers. MATDEVs/CBTDEVs should refer to Appendix A for their installation focal points. The MRMC and the CHPPM/AEHA can also provide support in defining HHA requirements.

Concept Exploration and Definition. MATDEVs/CBTDEVs request an IHHAR during this phase. The request is routed through the AMC surgeon. AMC, via its MSCs, provides matrixed HHA support to PEO-managed programs. If a system has only simple, low-level hazards, the AMC surgeon can perform the HHA. If the system has more complex health hazard issues and requires considerable technical effort, it is endorsed to CHPPM/AEHA to prepare the IHHAR. The CHPPM/AEHA or MRMC may be independent medical assessors (IMAs), depending on the nature of the issues being addressed. Subsequent HHA support may be coordinated directly for that system. The completed IHHAR is routed back through the Medical Command and the AMC surgeon for transmittal to the developer.

Demonstration and Validation. Health hazard data requirements identified in the IHHAR are included in TEMPs and DTPs by the MATDEV. Data collection to support health evaluations is the MATDEV's responsibility. MATDEVs will ensure that equipment capable of producing radiation or equipment which incorporates radioactive materials has been evaluated for potential health hazards by CHPPM/AEHA (AR 40-5, paragraph 9-9a). Health hazard data collected during the testing of Army materiel may be required when applying for a Federal license for Army use of the materiel. If an IHHAR was requested and prepared, the MATDEV will forward health hazard data to the lead IMA for evaluation. If an IHHAR was not previously requested, the developer will ensure that health hazard data has been collected or request support to collect the required data through the AMC surgeon as discussed in the preceding paragraph. Results of HHAs are used in system engineering to

HEALTH HAZARD ASSESSMENT PROCEDURES IN THE ACQUISITION LIFE CYCLE

reduce the health risk to Army personnel. Developer health risk reduction efforts will be validated by testing and further evaluation by the IMA.

Engineering and Manufacturing Development. Health hazard activities in this developmental phase continue the efforts established in the previous phase. Developer generated data continues to be assessed by the IMA and risk reduction methods instituted. The aim is to bring all health hazard issues to resolution prior to Milestone III.

Production and Deployment. Developers will develop special operational procedures required to mitigate, control, and manage any health hazard concerns which may impact on production and deployment of the materiel. Appropriate input from all health, safety, and maintenance specialists (such as Industrial Hygiene, Health Physics, etc.) should be requested during the development of all special procedures. Special operational procedures will be incorporated into doctrinal, operational, maintenance, and training publications and materials. Unresolved health hazard issues will be evaluated during post-production testing and the data forwarded to the IMA.

Operations and Support. Health hazard issues which are identified after fielding will be brought to the attention of the AMC surgeon's office. Request for support will be coordinated for appropriate disposition. Product improvements and other modification programs follow the same procedures described above.

To ensure HHA requests are processed expeditiously, it is important to provide adequate supporting documentation with the request. The required documentation may, of course, differ with each program but includes ORDs, MNS, SMMPs, TEMP, DTP, AS, IEP, SARs, and test reports. For most HHA support, 90 days is required to assess the system and prepare the report. If the assessment supports other program documentation (e.g., MANPRINT assessment), additional time should be allowed to coincide with the preparation requirements of that specific document.

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HHA technical support of Source Selection Evaluation Boards (SSEBs) may be requested via the AMC surgeon's office. An IMA will be designated to provide the necessary support. Support of SSEBs is reimbursable, and the designated IMA will provide support on an as needed basis.

■ *Source: HQ, USAMC, ATTN: AMCSG-H, MAJ Gary Shrum, 5001 Eisenhower Avenue, Alexandria, VA 22333-0001, and HQDA, ATTN: SGPS-PSP-E, LTC Gary M. Bratt, 5109 Leesburg Pike, Falls Church, VA 22041-3258. (MAJ Shrum is currently retired from active duty.)*

H E A L T H H A Z A R D A S S E S S M E N T P R O C E D U R E S I N T H E A C Q U I S I T I O N L I F E C Y C L E

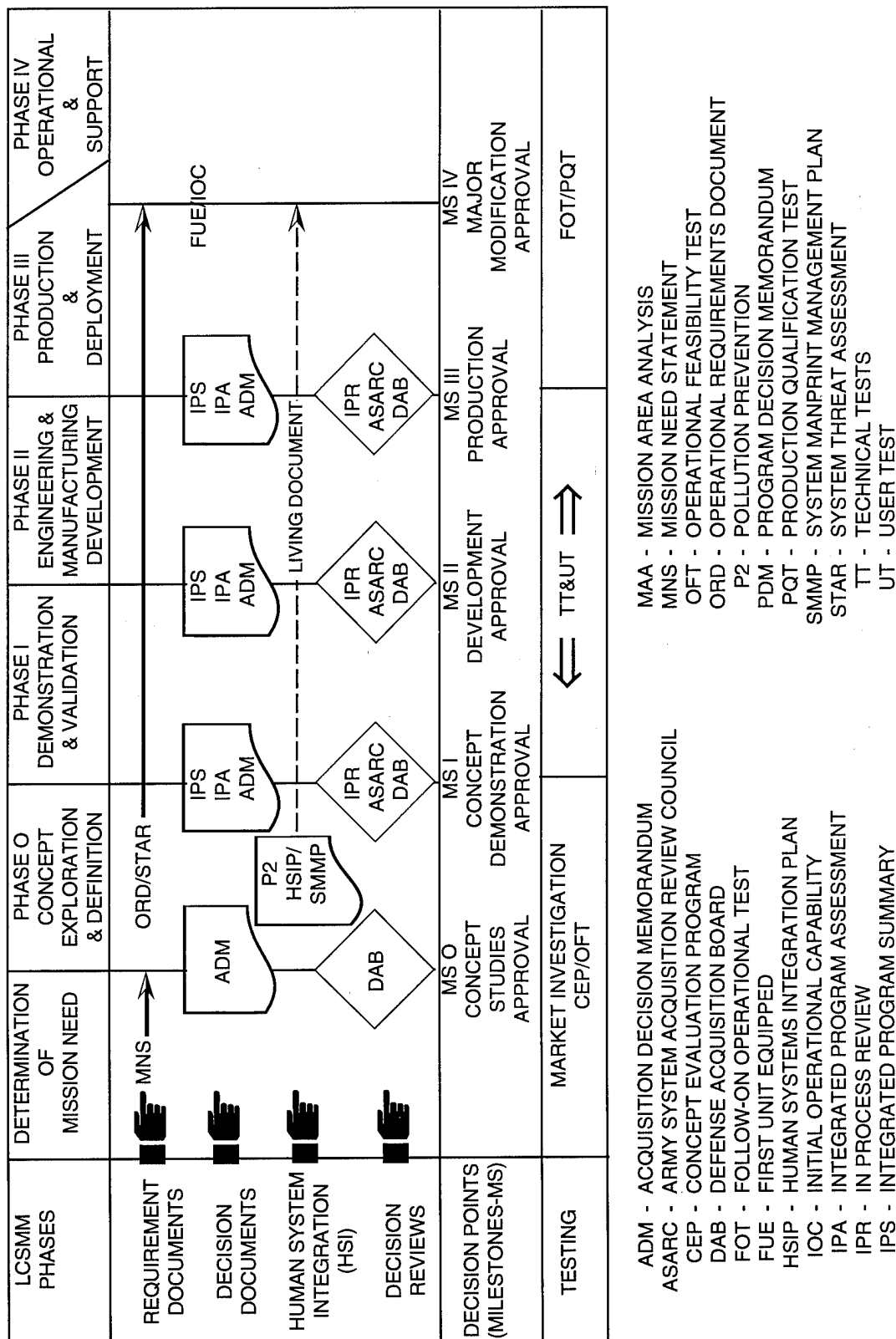


Figure E-1. Life cycle system management model overview

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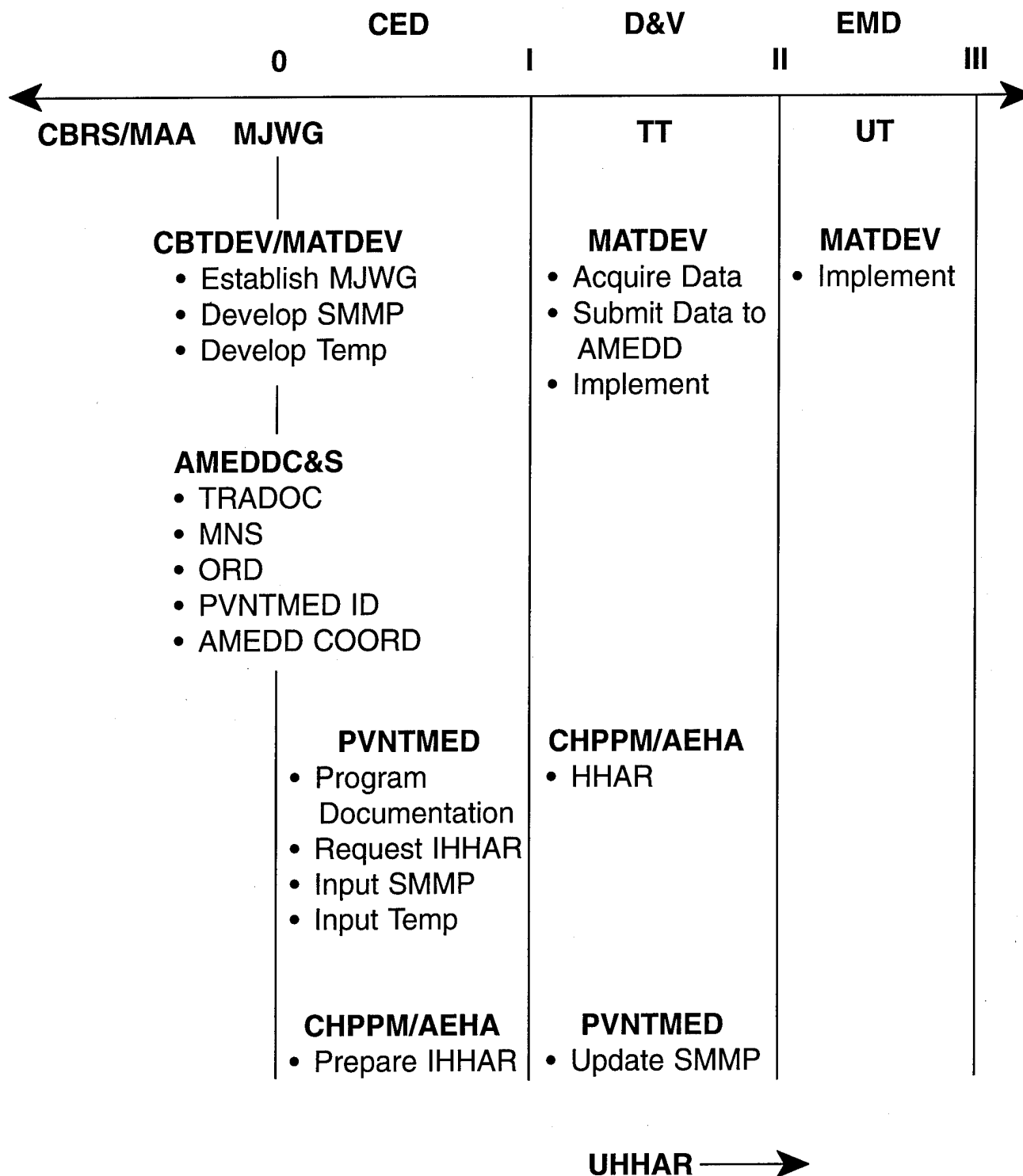


Figure E-2. Concept for improving early involvement

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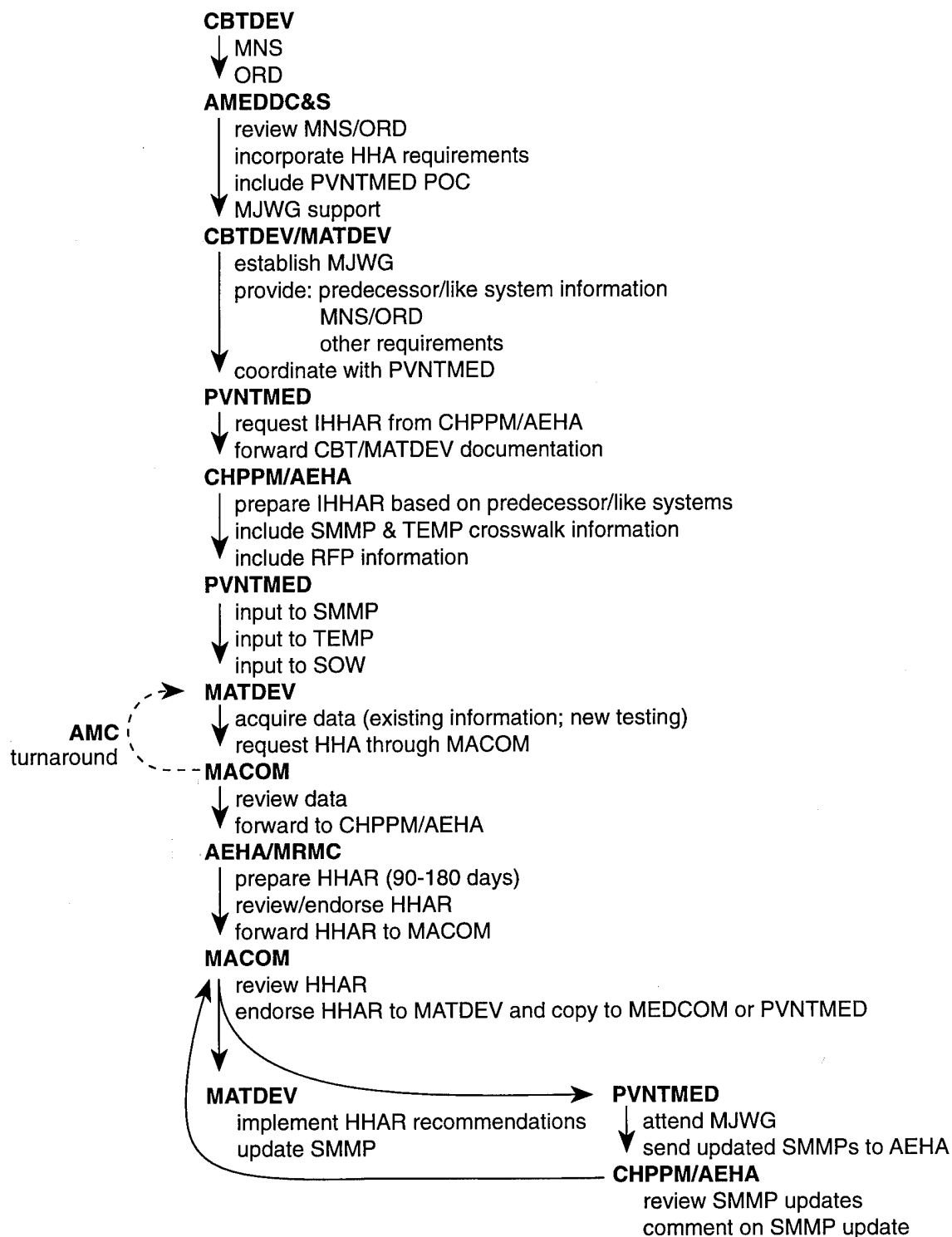


Figure E-3. Data input for SMMPs, TEMPs, SOWs, and other requirement documents

“Why do it early?”

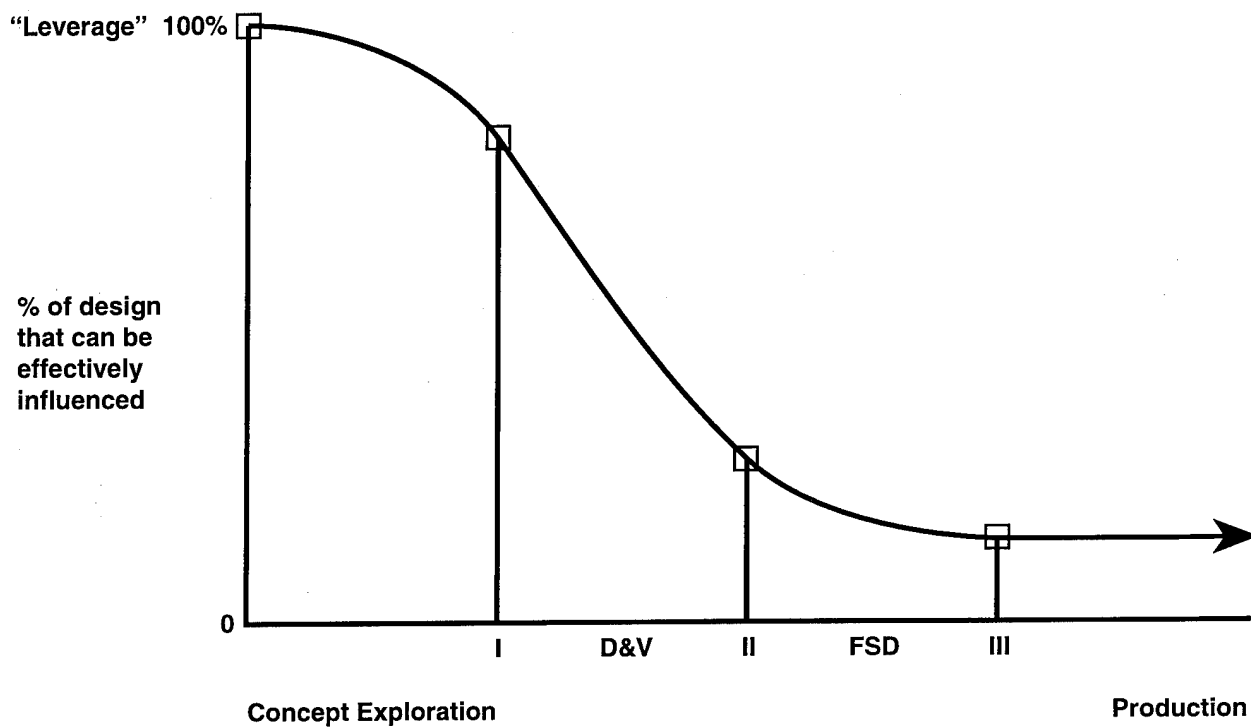


Figure E-4. Design maturity

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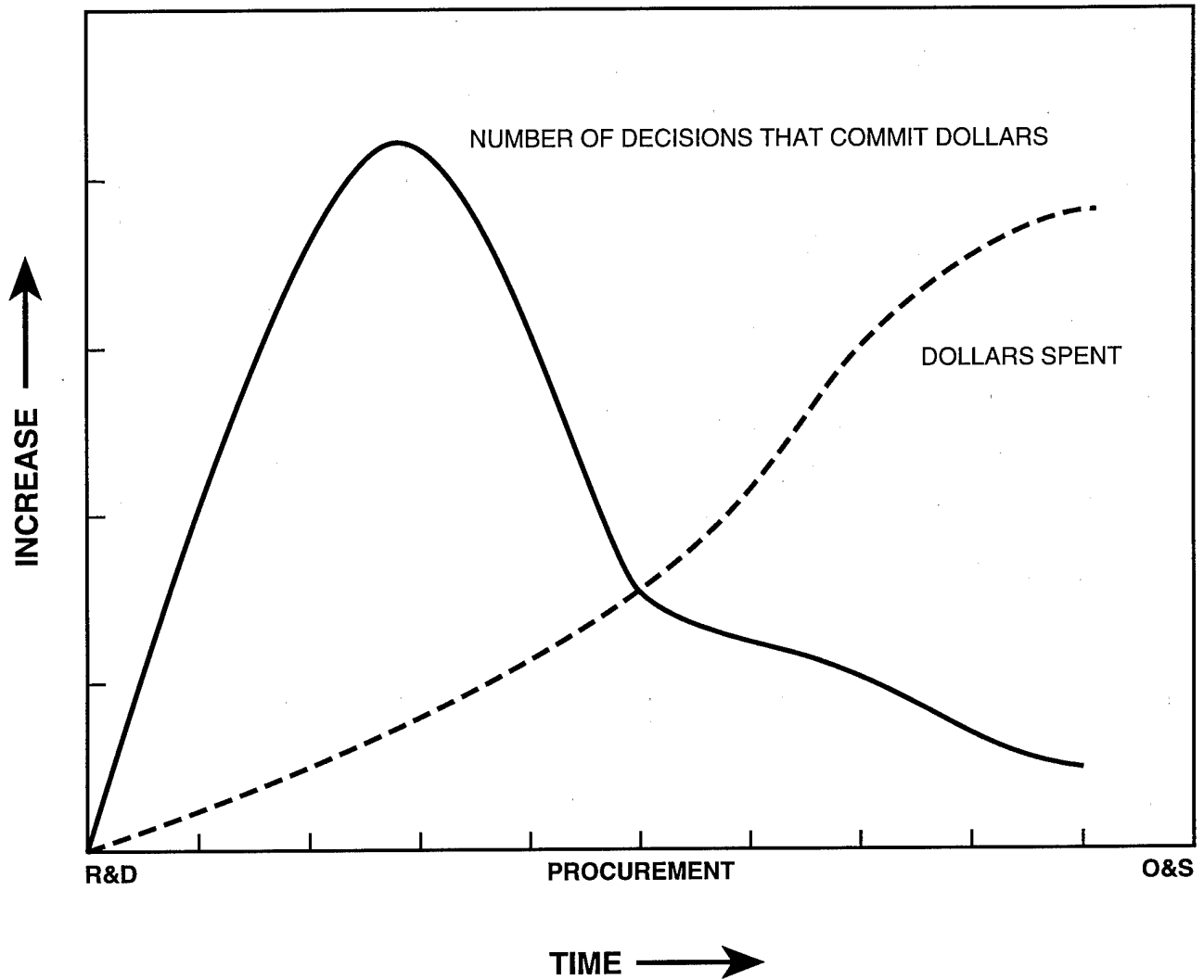


Figure E-5. Requirement for comprehensive accurate "front end" analysis

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H E A L T H H A Z A R D A S S E S S M E N T P R O C E D U R E S I N T H E A C Q U I S I T I O N L I F E C Y C L E

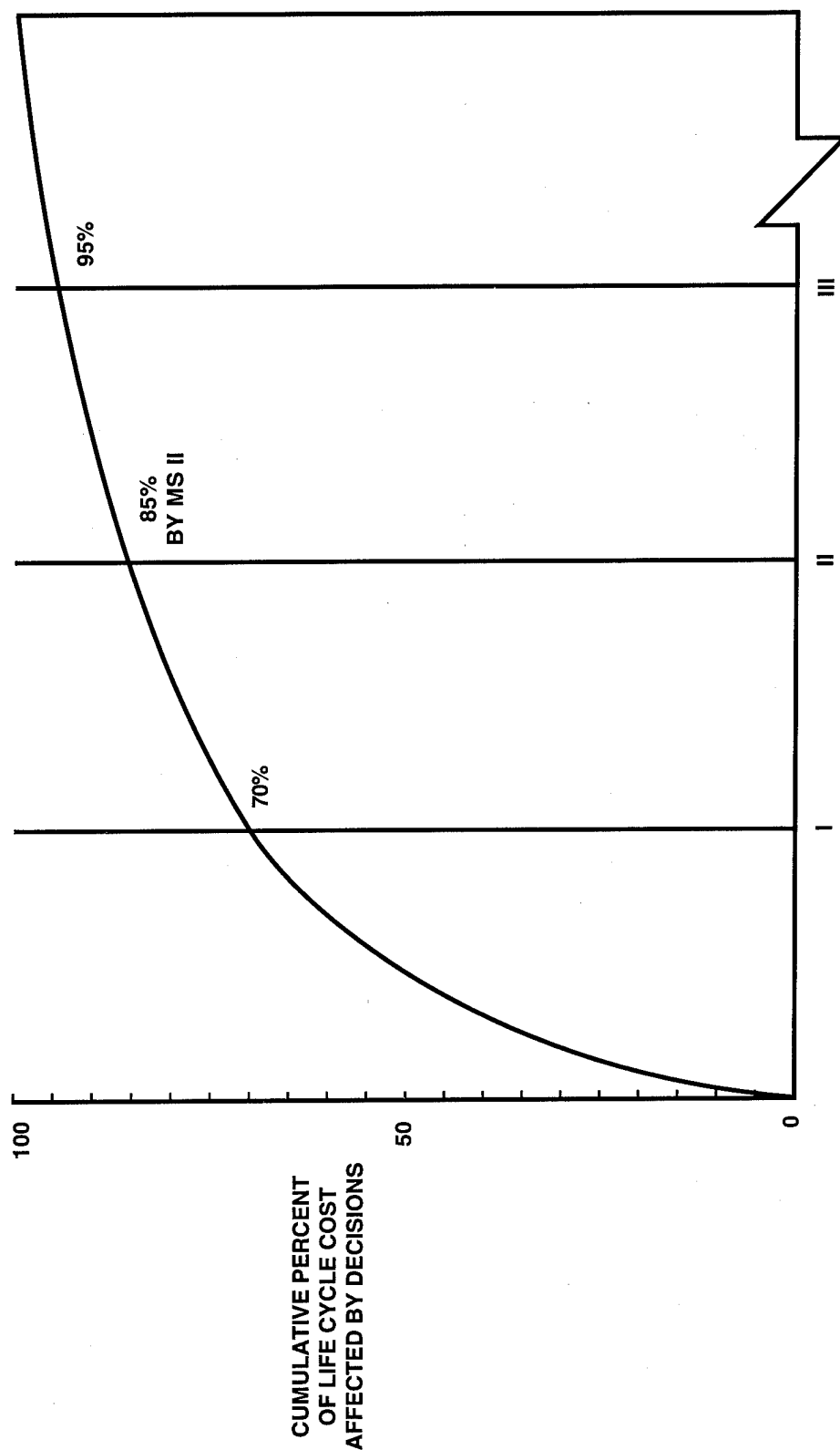


Figure E-6. Emphasis must come early in the process

APPENDIX F

Questionnaires and Checklists

■ This appendix contains a number of questionnaires and checklists to assist both independent medical assessors and combat/materiel developers in addressing health hazards and pollution prevention. While these helpful aids may not be all inclusive, they will provide you with quite a bit of assistance in ensuring health hazards have been addressed for all systems. The questionnaires provided are:

Health Hazard Assessment Report Questionnaire.

This questionnaire is to be used to obtain information from combat/materiel developers regarding a request for a health hazard assessment on their system.

Health Hazard Assessment General Questionnaire.

These questions can be used by both independent assessors and combat/materiel developers concerning a given system. They can provide a check on test and data requirements, test procedures, data that has been obtained, and modeling. Additionally, it asks some questions concerning the environmental and environmental health impacts of the system.

Health Hazard Issues Questionnaire.

This list of questions may be used to determine what the health hazard issues are with respect to a given system. They should be input into the System MANPRINT Management Plan as initial issues by independent medical assessors, MANPRINT coordinators, and combat/materiel developers. They should remain as issues

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until they have been addressed, resolved, closed, or the resultant risk has been accepted by the appropriate acquisition authority.

The checklists provided are:

General Health Hazard Internal Review Checklist.

This checklist should be used from a program management standpoint by combat/materiel developers to ensure that potential health hazards are taken into account during materiel acquisition and considered during the materiel acquisition decision process.

Health Hazard Inventory Checklist.

This checklist and accompanying information is to be used to ensure that health hazards have been addressed. It may be used by any person involved with the health hazard process. An inventory of systems health hazards narrative accompanies this checklist (it may be used with any list).

Combat/Materiel Developer Health Hazard Checklist.

This checklist should be used by developers to ensure they have addressed all health hazard categories with their particular system. It may also be used by independent assessors to determine the status of health hazard issues for a particular system.

Radiation Hazard Checklist for Combat and Materiel Developers.

This list may be used to determine what the radiation health hazard issues are with respect to a given system, and actions that may be required. They should be input into the SMMP by independent medical assessors, MANPRINT coordinators, and combat/materiel developers. They should remain as issues until they have been addressed, resolved, closed, or the resultant risk has been accepted by the appropriate acquisition authority.

Health Hazard Assessment Report Quality Checklist.

This checklist is to be used to ensure that a health hazard assessment report that has been generated is complete. It may be used by any person involved with the health hazard process who has a

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responsibility for preparing or reviewing a health hazard assessment report. It may also be used by management personnel from a document quality assurance perspective.

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QUESTIONNAIRES AND CHECKLISTS

HEALTH HAZARD ASSESSMENT REPORT QUESTIONNAIRE

This questionnaire consists of three pages.

Use this questionnaire to help gather pertinent information from the customer regarding their request for an HHAR.

1. System Nomenclature _____

2. Customer POC Name _____

Address _____

Phone _____ Fax _____

MACOM _____

Route of HHAR Request _____

3. Program Category

_____ ACAT-ID _____ II _____ IV
_____ IC _____ III

4. Purpose of System _____

5. System Components _____

6. Life Cycle System Phase:

_____ Phase 0 — Concept Exploration
_____ Phase I — Demonstration
_____ Phase II — Engineering
_____ Phase III — Production
_____ Phase IV — Operation/Support

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Is the system or a prototype available for CHPPM/AEHA POs to view? _____

If so, where and when? _____

Are funds available to support any HHA on-site work? _____

7. Purpose of this HHAR: What will this HHAR be used for and when is it required? _____

8. Acquisition Strategy:

- _____ Materiel Change
- _____ Product Improvement
- _____ Nondevelopmental Item

What health standards were applied in the product design? _____

What health problems surfaced during testing or in the market investigation? _____

_____ Developmental

9. Availability of the following:

MANPRINT Assessments:

- _____ Safety
- _____ Human Factors
- _____ Health Hazards
- _____ System MANPRINT Management Plan
- _____ IERs

Program Documents:

- _____ Mission Needs Statement
- _____ Operational Requirements Documents
- _____ Reliability, Availability, Maintainability Report
- _____ Operator Manual

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_____ Other assessments (environmental, other CHPPM/AEHA reports, AMC or OTSG turnarounds)

_____ Developer or user test data

10. Based on experience with previous HHARs on similar systems, the following health hazards can be expected: _____

If the customer requests the HHAR in less than 90 days and we lack the required data or documentation, ask the customer to attend a meeting of the initial working group to supply the required data and brief the POs on the specifics of the system.

■ *Source: CHPPM/AEHA, ATTN: MCHB-MO-A, LTC Murnyak, Aberdeen Proving Ground, MD 21010-5422.*

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HEALTH HAZARD ASSESSMENT GENERAL QUESTIONNAIRE

This questionnaire consists of two pages.

1. Are there appropriate guidelines and standards being observed regarding the product's anticipated performance (e.g., MIL STDs, etc.)? Yes _____ No _____
 2. Is there adequate evidence supporting the safety and health effects of this product? Yes _____ No _____
 3. Is supporting evidence pertinent to the health and safety issues raised by the product? Much evidence is frequently not relevant. Yes _____ No _____
 4. Does current evidence already exist to demonstrate the safety of the product and its health impact on its operators and users? Previously established data, models, and paradigms used to verify the safety and health effects of a product may not fit the current situation. If current evidence does not exist, new evidence must be generated by testing. Yes _____ No _____
 5. Are tests performed to evaluate product safety and health effects relevant? Yes _____ No _____
- Are tests properly conducted to show exactly what needs to be shown in order to demonstrate that the product is safe, effective, and not unhealthy to its operators and users? Yes _____ No _____
- Do the tests make sense? Yes _____ No _____
- Has pilot testing been done to focus further testing? Yes _____ No _____
- Are test sample sizes large enough to show what is intended? Yes _____ No _____
- Are test conditions set to discriminate among all pertinent outcomes? Yes _____ No _____
- Are test subjects representative of the target population? Yes _____ No _____
- Are test subjects representative of the user population? Yes _____ No _____

QUESTIONNAIRES AND CHECKLISTS

Are there enough tests to adequately cover all relevant considerations? Yes _____ No _____

6. If theoretical, statistical, computer, or other models are used to predict performance, safety, and health outcomes, are the models relevant? Yes _____ No _____

Are the assumptions associated with the model clearly spelled out, relevant to the situation, and valid? Yes _____ No _____

Are the limitations of such modeling acknowledged and taken into consideration? Yes _____ No _____

Has the modeling been validated for persons, conditions, and situations representative of persons, conditions, and situations encountered in actual use of the proposed product? Yes _____ No _____

Is this validation performed against an acceptable "gold standard"? Yes _____ No _____

How well accepted is the model by the research community in its application to the product and situation under consideration? Yes _____ No _____

7. How will this product affect the environment and populations living in the environment, both now and in the future? Yes _____ No _____

Will it pollute groundwater and other sources of water? Will this result in contamination of aquatic life, including fish and plant life? Will it create health problems for humans who subsist on affected fish or aquatic plant life or drink the affected water? Yes _____ No _____

Will it pollute the soil, vegetation, and animal life that subsist on the vegetation? Will it create health problems for humans who subsist on affected plant or animal life forms? Yes _____ No _____

Will it pollute the air? Will such pollution create health problems for human, animal, and plant life forms? Yes _____ No _____

■ Source: CHPPM/AEHA, ATTN: MCHB-MO-O, LTC Dave Wilder, Aberdeen Proving Ground, MD 21010-5422.

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HEALTH HAZARD ISSUES QUESTIONNAIRE

This questionnaire consists of three pages.

Acoustical Energy

1. Does this system meet the standards for steady-state noise under the most severe operational and maintenance scenarios? Yes _____ No _____
2. Does this system meet the standards for impulse noise under the most severe operational and maintenance scenarios? Yes _____ No _____
3. Does this system meet the standards for blast overpressure under the most severe operational and maintenance scenarios? Yes _____ No _____

Biological Substances

4. Does the system configuration preclude exposure to microorganisms, their toxins and enzymes? Yes _____ No _____

Chemical Substances

5. Does this system produce or release any toxic substance during maintenance and operation? Yes _____ No _____
6. Are personnel exposed to unacceptable levels of toxic gases or fumes? Yes _____ No _____
7. Are there any unacceptable levels of toxic gases in the crew compartment when the vehicle is operating and/or during weapons firing? Yes _____ No _____
8. Will any materials used decompose or react under extreme heat (pyrolytic) or in the presence of another substance to produce toxic fumes, gases, or vapors? Yes _____ No _____
9. Is the crew effectively/adequately protected against NBC agents? Yes _____ No _____
10. Has each chemical or toxic material used in or with the system been identified in the health hazard assessment report? Yes _____ No _____
11. Does a hazard from exposure to _____ exist? Yes _____ No _____

QUESTIONNAIRES AND CHECKLISTS

12. Are personnel adequately protected from fire extinguishing agents? Yes _____ No _____

Oxygen Deficient Atmosphere

13. Is there any potential for an oxygen deficient atmosphere in occupied spaces or compartments? Yes _____ No _____
14. Will occupied spaces contain HALON 1301 automatic fire extinguishing systems that comply with OTSG and NFPA requirements? Yes _____ No _____

Radiation Energy

15. Are there hazards or potential hazardous exposures from ionizing radiation sources during operation, training, and maintenance? Yes _____ No _____
16. Are there hazards or potential hazardous exposures from nonionizing radiation sources during operation, training, and maintenance? Yes _____ No _____
17. Are there hazards or potential hazardous exposures from _____ radiation sources during operation, training, and maintenance? Yes _____ No _____
18. Does the system contain any lasers detrimental to health? Yes _____ No _____
19. Has the system been evaluated for potential radiation health hazards by CHPPM/AEHA per AR 40-5? Yes _____ No _____

Physical Hazards

20. Will this system produce any physical hazards? Yes _____ No _____
21. Is adequate protection provided to preclude trauma to the eyes or body surface during system operation or from personal protective equipment? Yes _____ No _____
22. Does the system meet vibration and shock requirements under all operational conditions? Yes _____ No _____
23. Are there potential hazards from high pressure gases or fluids? Yes _____ No _____

QUESTIONNAIRES AND CHECKLISTS

24. Do hazards from excessive dust in crew compartments exist? Yes _____ No _____

Temperature Extremes

25. Is there any potential exposure to extreme heat or cold during operation or maintenance that will adversely affect personnel? Yes _____ No _____

26. Does the system provide adequate heating, cooling, and ventilation under routine, severe, and emergency conditions? Yes _____ No _____

27. Are there any hazards associated with cryogenics? Yes _____ No _____

Environmental Impacts

28. Are there any environmental impacts associated with the use of this system that later may impair health? Yes _____ No _____

29. Are there any health hazards associated with potential environmental contamination during and after use of this equipment? Yes _____ No _____

Miscellaneous

30. Have health problems identified with reference systems and components been addressed and abated in this system? Yes _____ No _____

31. Are there any health hazards associated with new technologies used to modify or upgrade the system? Yes _____ No _____

32. Are health hazards identified during IOT&E and FOT&E being resolved? Yes _____ No _____

33. Does the health hazard due to still exist (for system modification or update)? Yes _____ No _____

■ Source: "Health Hazard Assessment Survival Manual," ATTN: HSHM-PMA, MAJ Gary Herr, WBAMC, Ft. Bliss, TX 79916.

QUESTIONNAIRES AND CHECKLISTS

GENERAL HEALTH HAZARD INTERNAL REVIEW CHECKLIST

This checklist consists of three pages.

This checklist should be used by every combat developer/materiel developer (CBTDEV/MATDEV) for every newly developed/nondevelopmental item being considered for use by the U.S. Army.

Use the Remarks section in each question to explain the rationale for "yes" responses, or provide cross-references to where the rationale can be found. For "no" responses, cross-reference to where corrective action plans can be found. If response is "NA," explain rationale.

EVENT CYCLE 1: Health Hazard Identification

Step: Procedures for Health Hazard Identification

Risk: Materiel will be developed without taking into account potential health hazards to operators and maintainers.

Objective: Obtain required health hazard data on materiel systems with minimum expenditure of resources.

Technique:

- Identify potential health hazards early in the life cycle of a system.
- Avoid duplication of effort in collecting necessary data.
- Establish specific responsibilities for obtaining health hazard data.
- Determine use scenarios for equipment in order to properly evaluate identified hazards.

Questions

1. Have you instituted procedures to ensure that requirements documents reflect the need to consider potential health hazards in the development of a new system?

Yes _____ No _____
NA _____

Remarks: _____

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2. Have you instituted procedures to determine what health hazard information may be available on predecessor or similar systems? Yes _____ No _____
NA _____

Remarks: _____

3. Have you instituted procedures to involve the AMEDD in the review process for test plans to ensure that data relevant to potential health hazards are obtained? Yes _____ No _____
NA _____

Remarks: _____

4. Have responsible agencies instituted procedures to ensure that funds are programmed for the collection of necessary health hazard data? Yes _____ No _____
NA _____

Remarks: _____

5. Has the responsible agency instituted procedures to ensure that sufficient health hazard data are collected? Yes _____ No _____
NA _____

Remarks: _____

6. Have you developed system mission profiles for use in performing health hazard tests and evaluations? Yes _____ No _____
NA _____

Remarks: _____

QUESTIONNAIRES AND CHECKLISTS

EVENT CYCLE 2: Health Hazard Assessment Reports for New System

Step: Requests for Health Hazard Assessments of each new materiel system.

Risk: MATDEV will not consider potential health hazards during the materiel acquisition decision process.

Objective: Prepare a formal health hazard assessment report (HHAR) on all new systems unless hazards are negligible or deemed already adequately controlled by the AMEDD.

Technique:

- Formally consider health hazard information at milestone reviews of systems.
- Based on milestone decision reviews, take appropriate corrective action to resolve health hazards.

Questions

1. Are procedures in place to formally address health hazard information during milestone reviews?

Yes _____ No _____
NA _____

Remarks: _____

2. Are procedures in place to include health hazard information for these hazards which cannot be engineered out of the system into doctrinal, operational, maintenance, and training publications and materials?

Yes _____ No _____
NA _____

Remarks: _____

■ Source: HQDA, OTSG, ATTN: SGPS-PSP-E, 5109 Leesburg Pike, Falls Church, VA 22041-3258.

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HEALTH HAZARD INVENTORY CHECKLIST

This checklist consists of three pages.

SYSTEM _____

Temperature Extremes

Heat Stress (Ambient Heat) Yes _____ No _____
Cold Stress (Ambient Cold) Yes _____ No _____

Nonionizing Radiation

Laser Radiation Yes _____ No _____
Microwave/Radio Frequency Radiation Yes _____ No _____
Ultraviolet Radiation Yes _____ No _____
Infrared Radiation Yes _____ No _____
Visible Light Yes _____ No _____

Ionizing Radiation

Alpha Particles Yes _____ No _____
Beta Particles Yes _____ No _____
Gamma Rays Yes _____ No _____
X-rays Yes _____ No _____
Neutrons Yes _____ No _____

Chemical Substances

Fumes Yes _____ No _____
Vapors Yes _____ No _____
Smoke Yes _____ No _____
Mists Yes _____ No _____
Liquids Yes _____ No _____
Solids Yes _____ No _____
Gases Yes _____ No _____
Dust/Particulates Yes _____ No _____
CW Agents Yes _____ No _____

Psychological Stress

Confined Spaces Yes _____ No _____
Isolation (Spatial, Sensory, Social) Yes _____ No _____
Sensory/Cognitive Overload Yes _____ No _____

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Visual Illusions/Disturbances Yes _____ No _____
Bodily Disorientation (Vestibular,Kinesthetic) Yes _____ No _____
Sustained/High-Intensity Operations Yes _____ No _____

Oxygen Deficiency

Confined Space Yes _____ No _____
Ventilation Yes _____ No _____
High Altitude Yes _____ No _____

Biological Substances

Sanitation Yes _____ No _____
Hygiene Yes _____ No _____
Food Handling Yes _____ No _____
Potable Water Yes _____ No _____
Waste Disposal Yes _____ No _____

Acoustical Energy

Steady-State Noise Yes _____ No _____
Impulse Noise Yes _____ No _____
Blast Overpressure Yes _____ No _____

Shock

Acceleration Yes _____ No _____
Deceleration Yes _____ No _____
Recoil Yes _____ No _____

Trauma

Lifting Strain Yes _____ No _____
Neck Strain Yes _____ No _____
Blunt Injury Yes _____ No _____
Sharp Injury Yes _____ No _____
Cumulative Trauma Syndrome Yes _____ No _____

Vibration

Whole Body Yes _____ No _____
Segmental Yes _____ No _____

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Miscellaneous

BW Agents	Yes _____	No _____
Chemical Agents	Yes _____	No _____
Restricted Water Availability	Yes _____	No _____
Human Waste Elimination Constraints	Yes _____	No _____

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INVENTORY OF SYSTEMS HEALTH HAZARDS

A health hazard is some health-threatening condition that troops encounter in using materiel. The hazard can occur during normal use of equipment, interactions with environmental factors, maintenance and repair activities, logistics support functions, misuse, and malfunction. This appendix inventories the more frequently encountered health hazards and where they occur commonly in Army systems. The inventory is structured around five major categories: mechanical forces, chemical substances, biological substances, radiation energy, and environmental extremes.

Mechanical Forces

Among Army systems, the mechanical forces that can injure personnel include acoustical energy (noise), vibration, shock, and trauma. That these hazards tend to occur together is not surprising, since they go hand-in-hand with engines, drive trains, tracks and wheels, transmissions, rotors, guns/cannons, and munitions—components of Army vehicles or aircraft. Outlined here are the basic forms, generic sources, and common system/component sources of each type of mechanical force.

Noise, steady state: intermittent, sustained, narrow band, wide band. Arises from generating, transmitting, and converting power; drive elements interacting with ground or air; electronic reproduction or amplification of sound; gas or fluid flow/ friction; steady combustion. System source examples: tracked vehicles, wheeled vehicles, self-propelled artillery; aircraft (rotary- and fixed-wing); communication headsets and speakers; alerting or warning signals; power generators; training simulators; maintenance tools and equipment; gas torches; and compressed air/gas.

Noise, impulse: blast, impact, repetitive, nonrepetitive. Arises from propellant combustion; detonation of explosives; sudden release of pressure; forceful impact. System source examples: pistols, machine guns; grenades; mortars, cannons, tank guns, howitzers;

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recoilless rifles, rockets, missiles; nuclear warheads; explosives; training simulators; impact tools and equipment.

Blast overpressure: freefield, complex (reverberant), repetitive, nonrepetitive. Arises from propellant combustion and detonation of explosives. System source examples: mortars, cannons, tank guns, howitzers; recoilless rifles, rockets, missiles, explosives, nuclear warheads.

Vibration: high frequency, low frequency, linear, rotational, intermittent, sustained. Arises from generating, transmitting, and converting power; drive elements interacting with ground or air; resonance dynamics; induced changes or oscillations in system attitude or position. System source examples: tracked vehicles, wheeled vehicles, self-propelled artillery; aircraft (rotary- and fixed-wing); training simulators; maintenance tools and equipment.

Shock: acceleration, deceleration, force loading. Arises from system impact (crash, collision, hard landing); system recoil; sudden aircraft displacement due to air turbulence; windblast; parachute opening. System source examples: aircraft (rotary- and fixed-wing); wheeled vehicles, tracked vehicles, self-propelled artillery; parachute systems.

Trauma: blunt, sharp, musculoskeletal. Arises from objects or components impacting soldier; weapons blast; weapons recoil; shattering of compounds of materials; limb or head flail due to vehicle/terrain interaction; airblast; musculoskeletal overload. System source examples: tracked vehicles, wheeled vehicles; artillery (towed, self-propelled); tank guns; aircraft (rotary- and fixed-wing); hand-held guns, shoulder fired rockets/missiles; maintenance tools and equipment; compressed air/gas; explosive training devices; excessive operator force/exertion.

Chemical Substances

Usually thought of as toxic substances, these are among the most pervasive health hazards. Chemically active compounds enter the

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picture frequently in basic system construction (e.g., paints, sealants, adhesives), routine operations and logistical support (e.g., fuels, coolants), maintenance (e.g., solvents, cleaning agents), and special functions (e.g., fire/flame suppression, decontamination). Contrasting with these is another family of substances generated by normal system operations, usually by-products of engine combustion and weapons combustion. Of course, the specific fuels and propellants used will influence the by-products encountered, as will a host of other factors. The basic forms in which primary substances and by-products occur—liquids, gases, and solids—will guide the following summaries.

Liquids: including mists, aerosols. Associated with fueling, maintaining, and repairing systems; systems salvage and disposal; pest and plant control; decontamination; generation of obscurants; sewage handling and treatment. Common types include fuels, lubricants, coolants, hydraulic fluids, solvents, cleaning agents, paints, adhesives, pesticides, herbicides, defoliants, decontamination solutions. System source examples: systems incorporating combustion engines (piston, turbine), hydraulics, air conditioners; systems for handling, storing, and transporting fuel and other petroleum products; maintenance shop; paint shop; repair shop; sewage handling and treatment systems; systems for handling, storing, transporting, and dispensing pesticides, herbicides, and defoliants; decontamination systems; fog oil generators.

Gases and vapors: arise from vaporization of liquids or solids; engine combustion; weapons combustion; compressed gas; air filtration; electric motors; welding; flame/fire suppression. System source examples: systems incorporating combustion engines (piston, turbine), hydraulics, air conditioners; systems for handling, storing, and transporting fuels and other petroleum products; maintenance shop; paint shop; repair shop; gas torches; machine guns, tank guns, cannons, mortars, howitzers, recoilless rifles, rockets, missiles; gaseous fire suppression systems (e.g., Halon); systems for handling, storing, transporting, and dispensing pesticides, herbicides, and defoliants; sewage handling and treatment

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systems; compressed gas systems and containers; liquid decontamination systems; protective filters.

Solids: coatings, aerosols, fumes, dusts, particulates. Arise from system environment interaction; burning materials; generation of smokes/obscurants; construction activities; blasting; welding, brazing, soldering; cutting, grinding, and sanding of metals, plastics, wood; decontamination; pest and plant control; air filtration. System source examples: tracked vehicles; wheeled vehicles; aircraft (rotary- and fixed-wing); artillery (towed, self-propelled); munitions; explosives; smoke/obscurant systems; construction equipment; maintenance shop; paint shop; repair shop; power saws, grinders, sanders; welding, brazing, and soldering equipment; powder-form decontamination systems; systems for handling, storing, transporting, and dispensing pesticide and herbicide dusts; protective filters.

Biological Substances

This category arises mainly from contamination or infiltration of systems by disease-causing microorganisms that reside in the earth's environment. Common types include bacteria, viruses, parasites, Rickettsia, molds, and fungi. These organisms may grow (or at least survive) wherever there is a "reservoir" containing a hospitable medium, such as water or nutrified liquid. System reservoir examples: containers, tanks, lines, tubes, compartments, and receptacles where a hospitable liquid may occur, collect, or circulate; system for processing, handling, storing, transporting, preparing, and dispensing foodstuffs (both solid and liquid forms) and water; medical supplies and biologicals; waste disposal equipment; sanitation systems; sewage handling and treatment systems.

Radiation Energy

The common types of radiation that accompany Army systems include visible light, infrared, ultraviolet, radiofrequency energy, laser energy, and ionizing radiation. Systems or subsystems designed for special functions, especially of an electrical or electronic nature, most frequently give rise to these types of energy. The

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sections below summarize the basic forms and generic sources of each type of radiation.

Radiofrequency energy: microwaves, millimeter waves, transient, sustained. Generic sources: telecommunications systems, radar systems, microwave ovens.

Infrared: sustained, transient. Generic sources: heating elements (such as those used in food preparation equipment and space heaters), gas torches, soldering equipment, electronic repair equipment, laser radiation.

Visible light, high intensity: artificial, natural, transient, sustained. Generic sources: search lights, landing lights, strobes, high-intensity lamps, cathode ray tubes, natural sunlight, highly reflective surfaces, laser radiation, gas torches, nuclear flash.

Ultraviolet: near UV, far UV, artificial, natural, transient, sustained. Generic sources: ultraviolet lamps, electric arc welding and cutting, gas discharge tubes, natural sunlight (varies with season, altitude, etc.).

Laser energy: pulsed, transient, sustained. Generic sources: rangefinders, target designators, training simulators, sensor-targeted countermeasure systems, material processing systems.

Ionizing radiation: transient, sustained. Generic sources: high-voltage electronics, x-ray equipment, radioluminescent materials, nuclear weapons, depleted uranium munitions.

Environmental Extremes

On the training range and the battlefield, environmental factors such as temperature, humidity, wind, and altitude obviously interact with combat systems and their operators. In their extreme forms and combinations, these factors may threaten the soldier's health. In the case of Army materiel, we are concerned with three categories of

QUESTIONNAIRES AND CHECKLISTS

environmental extremes—ambient heat, ambient cold, and oxygen deficiency.

Ambient heat: convective, radiant, natural, artificial, transient, sustained. Arises from environmental heat, sunlight; heat-generating systems and subsystems; human metabolism. System source examples: tracked vehicles, wheeled vehicles; self-propelled artillery; aircraft (rotary- and fixed-wing); cannons, guns, rockets, missiles (as components of systems with enclosed crew compartments); training simulators; collective shelters; protective clothing, helmets, masks, respirators, gloves, boots; food preparation equipment; heaters; lamps; electrical/electronic equipment. Contributing factors: humidity, wind, clothing, workload.

Ambient cold: natural, artificial, transient, sustained. Arises from environmental cold, ice; cooling subsystems. System source examples: tracked vehicles, wheeled vehicles; self-propelled artillery; aircraft (rotary- and fixed-wing); systems/ subsystems for air conditioning, refrigeration, and frozen storage; training simulators; collective shelters. Contributing factors: humidity, moisture, wind, clothing, workload.

Oxygen deficiency: natural, artificial, transient, sustained. Arises from high altitude (terrestrial, airborne); oxygen displacement in confined spaces; systems that constrain breathing. System source examples: aircraft (rotary- and fixed-wing); airborne operations; high-altitude operations; altitude chamber; gaseous fire suppression systems; protective masks, respirators. Contributing factors: workload, ambient temperature, engine combustion fumes, weapons combustion fumes, fuel vapors.

■ Source: "Health Hazard Assessment Primer," USAARL Report 90-5, USAARL, ATTN: SGRD-VAS, LTC Bruce Leibrecht, Fort Rucker, AL 36362-5292, and HQDA, OTSG, ATTN: SGPS-PSP, LTC Gary M. Bratt, 5109 Leesburg Pike, Falls Church, VA 22041-3258.

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COMBAT/MATERIEL DEVELOPER HEALTH HAZARD CHECKLIST

This checklist consists of seven pages.

	Conform	Remarks
1. a. Is this or associated equipment free from noise hazards? If your response is no, answer question b.		
b. Are noise levels less than 85 dBA for steady state or 140 dBP for impulse [DA PAM 40-501, MIL-STD 1474C (5.1), MIL-STD 1472D (5.8.3)]. If your response is no, answer questions c, d, and e.		
c. Can noise levels be reduced or eliminated by design modifications?		
d. Are noise hazard warnings and/or safeguards provided on the equipment and in the technical manuals?		
e. If generators are required, is the noise level at the operator's position < 85 dBA and within 7 meters in any direction \leq 70 dBA?		
f. What is the estimated TWA noise exposure?		
2. a. If headsets, handsets, earphones, etc., are required to be used with the equipment, are noise hazard warnings and/or safeguards provided on the equipment and in the technical manuals?		
b. Is a hearing protector evaluation required?		
3. a. Is the equipment (during operation, maintenance, storage, and/or disposal) free from hazardous or potentially hazardous materials (e.g., toxics, flammables, ignitables, corrosives, reactives, explosives, oxidizers, carcinogens) (29 CFR 1910.1200, FED-STD 313C, MIL-STD 454M Req 1)? If your response is no, answer questions b, c, and d.		

QUESTIONNAIRES AND CHECKLISTS

Conform Remarks

b. Has a Material Safety Data Sheet (MSDS) or equivalent been completed and submitted to the government?

c. Can nonhazardous materials be substituted?

d. Are potential exposures to hazardous materials controlled to levels below the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL) and/ or American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV) (use the most stringent standard)? If your answer is no, answer question e.

e. How will actual/potential exposures be controlled (e.g., engineering control, use of personal protective equipment, administrative control)?

4. a. Is this equipment free of advanced composite materials? If your response is no, answer question b.

b. What are the advanced composite materials (e.g., textile glass fiber, carbon/graphite fiber, aramid fiber, ceramic fiber, composite matrix) that are being used?

5. a. Is the shelter and/or vehicle unoccupied during normal operations and/or maintenance?

Shelter?

Vehicle?

If your response is no, answer questions b, c, d, and e.

b. Is the ECU sufficient to maintain temperatures within the shelter and/or vehicle between 65-85° F to prevent heat or cold stress [MIL-STD 1472D (5.8.1.1, 5.8.1.3), ACGIH TLVs]?

c. Is adequate ventilation provided within the shelter and or vehicle [MIL-STD 1472D (5.8.1.2)]?

QUESTIONNAIRES AND CHECKLISTS

Conform

Remarks

d. Are light levels within the shelter sufficient to conduct normal operations [MIL-STD 1472D (5.8.2)]?

e. Will the system only be operated without the use of a generator, vehicle, etc.? If your response is no, answer question f.

f. Are personnel precluded from being in or near the shelter and/or vehicles with generators operating and/or vehicle engine idling during operations and maintenance [MIL-STD 1472D (5.8.1.2)]? If your response is no, answer questions g, h, and i.

g. How far away is the generator from the shelter (in feet)?

h. Is the vehicle and/or generator exhaust directed away from the shelter and/or vehicle openings to prevent accumulation of diesel exhaust emissions in the shelter and/or vehicle?

i. (1) Has air sampling been conducted to determine potential diesel exhaust concentrations within the shelter and/or vehicle? If your response is yes, indicate levels.

i. (2) Are the diesel exhaust levels within the shelter or vehicle below the OSHA PEL and/or ACGIH TLVs for the following substances:

Substance	[part per million (ppm)]	
	8 Hr TWA	STEL
Carbon Monoxide	25	N/A
Formaldehyde	0.75	2
Sulfur Dioxide	2	5
Acrolein	0.1	0.3
Nitric Oxide	25	N/A
Nitrogen Dioxide	3	5

QUESTIONNAIRES AND CHECKLISTS

	Conform	Remarks
6. a. Is the equipment free of insulating materials (e.g., shelter, vehicle, or item)? If your response is no, answer questions b and c.		
b. What is the insulating material (e.g., asbestos, fibrous glass, mineral wool, polystyrene foam, polyurethane foam) being used?		
c. Are appropriate warnings and/or safeguards provided on the equipment and in the technical manuals?		
7. a. Is this or associated equipment free from ozone-depleting substances (Clean Air Act, DODD 6050.9)). If your response is no, answer questions b, c, and d.		
b. What are the ozone-depleting substances being used (e.g., CFC-11, CFC-12, CFC-113, CFC-114, CFC-115, CFC-16, CFC-17, R-500, R-502, R-503, HCFC-22, HCFC-123, HCFC-21, HCFC-31, HCFC-122, HCFC-124, HCFC-131, HCFC-132, HCFC-133, HCFC-141, HCFC-142, HCFC-221, HCFC-223, HCFC-224, HCFC-225, HCFC-226, HCFC-231, HCFC-232, HCFC-233, HCFC-235, HCFC-241, HCFC-242, HCFC-243, HCFC-244, HCFC-251, HCFC-252, HCFC-253, HCFC-261, HCFC-262, HCFC-271, Halon 1211, Halon 1301, Halon 2402, Methyl Chloroform, Carbon Tetrachloride).		
c. Are appropriate warnings and safeguards provided on the equipment and in the technical manuals?		
d. Can substitutes be used?		
8. a. Is this or associated equipment free of batteries? If your response is no, answer questions b, c, d, e, f, g, and h.		

QUESTIONNAIRES AND CHECKLISTS

	Conform	Remarks
b. Is the battery(ies) the primary power source or backup power source?		
c. Is the battery in the government inventory? If your response is yes, answer questions d and e.		
d. What is the battery's nomenclature (i.e., BB-xxx, BA-xxx) and NSN (i.e., 6140-xx-xxx-xxxx)?		
e. What is the battery's chemistry (i.e., alkaline, carbon-zinc, lead acid, lithium, magnesium, mercury, nickel-cadmium, silver)?		
f. Has U.S. Army Research Laboratory (ARL) approved the battery assignment for this equipment (AMC-R 700-83, MIL-STD-454M Req 27)?		
g. Will the battery enclosure or box prevent injury or damage (personnel and equipment) in the event of a violent gas venting or rupture of the battery cells (CECOM Safety Office Technical Bulletin #7)?		
h. Are secondary [rechargeable (6140- xx-xxx-xxxx)] batteries vented to the outside [29 CFR 1910.178(g)(2), MIL- STD 1472D (5.8.1)]?		
i. Are primary [nonrechargeable (6135-xx-xxx-xxxx)] batteries vented to prevent overpressurization [29 CFR 1910.178(g)(2), MIL-STD 1472D (5.8.1)].		
9. Are appropriate fire extinguishers located in/on the vehicle (i.e., 10- B:C carbon dioxide) and generator (i.e., 5-B:C dry chemical)?		

QUESTIONNAIRES AND CHECKLISTS

	Conform	Remarks
10. a. Is this item or associated equipment free from the use of video display terminals (VDTs) and keyboards? If your response is no, answer question b.		
b. Have the ergonomic effects associated with the use of VDTs/ keyboards/workstations been controlled (DOD-HDBK-763, NIOSH Recommendations for VDT Workstations, MIL-STD 1472D)? (See Appendix J for automated information system hazards and guidelines.)		
11. Are there any other health hazards associated with the equipment (i.e., biological substances, shock, trauma, vibration) not previously addressed ? If your response is yes, list the hazards. (See Appendix B for a list of hazards.)		
12. Are there fire hazards present?		
13. Is the heater exhaust pipe located as far as possible from the fuel intake valve?		
14. Does the heater exhaust pipe routing prevent the concentration of carbon monoxide in the shelter?		
15. Are fuel cans located outside the shelter and at a safe distance from the heater?		
16. Are battery compartments forced-air ventilated to the outside?		
17. Is a warning device provided to indicate when either the battery vent lid or door is closed or when the ventilation fan is inoperable?		
18. Are warning labels provided to indicate possible explosive gas accumulations?		
19. Does the system employ laser technology, sources of infrared radiation, or bright visible light? If yes, list the source.		

QUESTIONNAIRES AND CHECKLISTS

20. Have toxicity clearances been obtained from CHPPM/AEHA for any item with potential human contact (e.g., clothing, coatings, paints, plastics, etc.)?

21. a. Have any radiofrequency radiation sources been identified?

b. Has CHPPM/AEHA evaluated the system IAW AR 40-5?

c. Has the design been optimized to reduce this hazard?

d. Have overexposure threats been identified?

e. How will overexposure potential be managed?

■ *Source: HQ, CECOM, ATTN: AMSEL-SF, Mr. Ian Rosenblum, Fort Monmouth, NJ 07703-5000, and CHPPM/AEHA, ATTN: MCHB-MO-A, LTC George Murnyak, Aberdeen Proving Ground, MD 21010-5422.*

QUESTIONNAIRES AND CHECKLISTS

RADIATION HAZARD CHECKLIST FOR COMBAT AND MATERIEL DEVELOPERS

This checklist consists of two pages.

1. A potential radiation hazard exists if you can answer yes to any of the following questions:
 - a. Does the system have a television receiver?
 - b. Is there radioactive material incorporated into any component?
 - c. Are there indications that a cold-cathode gas discharge tube is in the component?
 - d. Does the system contain a laser device?
 - e. Is there a radiofrequency emitting device on the system?
2. If a potential hazard exists, the following action may be required:
 - a. A health hazard evaluation (AR 40-5, paragraph 9-9a).
 - b. Verification that x-ray laser devices meet 21 CFR requirements.
 - c. Verification that radioactive material sources meet appropriate American National Standards.
 - d. Verification that radioactive material is authorized by a Nuclear Regulatory Commission license or DA authorization.
 - e. System certification.
 - f. Development of special operational procedures for production and deployment.
3. Data needed to perform an IHAR and HHAR:
 - a. Health hazard evaluation data.
 - b. Radioactive source specifications.
 - Isotope (e.g., tritium, uranium-238, etc.).
 - Amount of isotope in system.

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- Form of the isotope (gas, liquid, solid).
- Radioactive source sealed, unsealed, plated, or foil.
- c. Storage and use requirements.
- d. Maintenance requirements.
- e. Disposal requirements.
- f. Any special handling requirement.
- g. Specifications on laser, x-ray systems, and RF emitting devices.

■ *Source: CHPPM/AEHA, ATTN: MCHB-MR, Aberdeen Proving Ground, MD 21010-5422.*

QUESTIONNAIRES AND CHECKLISTS

HEALTH HAZARD ASSESSMENT REPORT QUALITY CHECKLIST

This checklist consists of three pages.

PROJECT TITLE AND NUMBER _____

Summary

- _____ 1. Purpose and brief system description.
- _____ 2. Identify principal health hazards.
- _____ 3. Refer to assessments and recommendations section.
- _____ 4. Give a one sentence assessment of the system as a whole.

Background

- _____ 5. General system description (product improvement, replacement, new system).
- _____ 6. Phase in the life cycle model?
- _____ 7. List system components, how they are used, and by whom under what conditions?
- _____ 8. Purpose of HHAR and how it will be used.
- _____ 9. Summary of previous assessments (i.e., HHA, SAR, HFEA, EAR) used to prepare report.

Identification

- _____ 10. Brief statement of how hazards were identified (site visit document reviews, meetings).
- _____ 11. List of principal hazards.

Assessments

- _____ 12. Describe each hazard in terms of levels of exposure for a given use scenario (level, duration, frequency, and routes of exposure).
- _____ 13. Describe the medical effects of exposure.

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- _____ 14. Assess the risk of health impairment based on the known information (exposure factors and health criteria).
- _____ 15. Clearly state assumptions used and list data voids that need to be filled to complete the assessment.
- _____ 16. Identify specific data requirements and appropriate test methods to collect this data.
- _____ 17. Keep the purpose of a HHAR and system life cycle stage in mind.
- _____ 18. Include the level of detail necessary to support recommendations.
- _____ 19. Include pertinent experience factors from previous HHARs.

Recommendations

- _____ 20. Be specific.
- _____ 21. Supported by the Hazard Assessment Section.
- _____ 22. Be clear, concise, and use the active voice.
- _____ 23. Challenge developers to eliminate hazards, but keep in mind the stage in the life cycle. Provide appropriate alternatives.
- _____ 24. Minimize the use of PPE in initial HHARs.
- _____ 25. Check RACs for agreement and accuracy. RACs are used to denote the health risk if recommendation is not followed.

AR 40-10

HS	HP				
	A	B	C	D	E
I	1	1	1	2	3
II	1	1	2	3	4
III	2	3	3	4	5
IV	3	5	5	5	5

QUESTIONNAIRES AND CHECKLISTS

References and Appendices

_____ 26. References match, cited, and are current.

_____ 27. Appendices are correctly labeled.

Comments _____

■ *Source: CHPPM/AEHA, ATTN: MCHB-MO-A, LTC George Murnyak, Aberdeen Proving Ground, MD 21010-5422.*

APPENDIX G

Health Hazard/Hazardous Material Information for Input into the Request for Proposal

■ This appendix contains task 207 from MIL-STD-882C, System Safety Program Requirements, and the accompanying Data Item Description (DID) for a Health Hazard Assessment Report (HHAR). Government requests for proposals (RFP) to a contractor should contain a description of specific hazardous materials, health hazards, and their impacts in accordance with MIL-STD-882C.

This report is required to be prepared by a "contractor" and is not the same as the HHAR described in AR 40-10. There is a DID for a Pollution Prevention Program Plan. This information, when addressed in the contractor's proposal, provides a basis for the evaluation of a system or comparison of systems from a health hazard standpoint in the source selection evaluation process.

Additionally, to eliminate the need of a military specification or standard, Army, Navy, and Air Force representatives worked with the Aerospace Industries Association to develop an industry standard that will meet Government hazardous and environmentally unacceptable material management requirements. The effort resulted in National Aerospace Standard (NAS) 411, Hazardous Materials Management Program.

**MIL-STD-882C, Task 207,
Health Hazard Assessment**

Purpose.

207.1 The purpose of Task 207 is to perform and document a Health Hazard Assessment (HHA) to identify health hazards, evaluate proposed hazardous materials, and propose protective

measures to reduce the associated risk to a level acceptable to the MA.

Task Description.

207.2 An HHA shall be performed and documented to identify health hazards and to recommend engineering controls, equipment, and/or protective procedures, to reduce the associated risk to a level acceptable to the MA. An HHA shall also evaluate the hazards and costs due to system components materials, evaluate alternative materials for those components, and recommend materials that reduce the associated risk. Materials will be evaluated if (because of their physical, chemical, or biological characteristics; quantity; or concentrations) they cause or contribute to adverse effects in organisms or off-spring, pose a substantial present or future danger to the environment, or result in damage to or loss of equipment or property during the system life cycle. Assessments shall include consideration of the generation of hazardous wastes.

207.2.1 Specific health hazards and impacts that shall be considered include:

- a. Chemical hazards (e.g., hazardous materials that are flammable; corrosive; toxic; carcinogens or suspected carcinogens; systemic poisons; asphyxiants, including oxygen deficiencies; respiratory irritants; etc.).
- b. Physical hazards (e.g., acoustical energy, heat or cold stress, ionizing and nonionizing radiation).
- c. Biological hazards (e.g., bacteria, fungi, etc.).
- d. Ergonomic hazards (e.g., lifting requirements, task saturation, etc.).
- e. Other hazardous, or potentially hazardous, materials that may be formed by the introduction of the system, or by the manufacture, test, maintenance, or operation of the system.

207.2.2 The assessment shall address:

- a. System, facility, and personnel protective equipment design requirements (e.g., ventilation, noise attenuation, radiation

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barriers, etc.) to allow safe operation and maintenance.

When feasible engineering designs are not available to reduce hazards to acceptable levels, alternative protective measures must be specified (e.g., protective clothing, specific operation or maintenance practices to reduce risk to an acceptable level).

- b. Potential non- or less hazardous material substitutions and projected handling and disposal issues. The HHA will discuss the rationale for using a hazardous material and long-term effects (such as potential for personnel and environmental exposure, handling and disposal issues/requirements, protection/control measures, and life cycle costs) over a non- or less hazardous material. The effects and costs should be considered over the life of the systems, including the cost of handling and disposal. Identify potential non- or less hazardous alternatives if they exist and provide a justification why an alternative cannot be used.
- c. Hazardous material data. The HHA shall describe the means for identifying and tracking information for each hazardous material.

207.2.3 The HHA hazardous material evaluation shall:

- a. Identify the hazardous materials by name(s) and stock number(s); the affected system components and processes; the quantity, characteristics, and concentrations of the materials in the system; and source documents relating to the materials.
- b. Determine under which conditions the hazardous materials can release or emit materials in a form that may be inhaled, ingested, absorbed by living organisms, or leached into the environment and if the materials pose a health threat.
- c. Characterize material hazards and determine reference quantities and hazard ratings. Acute health, chronic health, carcinogenic, contact, flammability, reactivity, and environmental hazards will be examined.

- d. Estimate the expected usage rate of each hazardous material for each process or component for the subsystem, total system, and program-wide impact.
- e. Recommend the disposition of each hazardous material identified. If for any scale of operation the reference quantity is exceeded by the estimated usage rate, material substitution or altered processes shall be considered to reduce risks associated with the material hazards while evaluating the impact on program costs.

207.3 DETAILS TO BE SPECIFIED.

207.3.1 Details to be specified in the SOW shall include the following as applicable:

- (R) a. Imposition of Tasks 101 and 207.
- b. Minimum hazard severity and probability reporting thresholds.
- c. Any selected hazards, hazardous areas, hazardous materials, or other specific items to be examined or excluded.
- d. Specification of desired analysis techniques and/or report formats.

DATA ITEM DESCRIPTION

1. IDENTIFICATION NUMBER. DI-SAFT-80106A
2. TITLE. Health Hazard Assessment Report
3. DESCRIPTION/PURPOSE. Health Hazard Assessment Reports are used to systematically identify and evaluate health hazards, evaluate proposed hazardous materials, and propose measures to eliminate or control these hazards through engineering design changes or protective measures to reduce the risk to an acceptable level.
4. APPROVAL DATE. 19 January 1993
5. OFFICE OF PRIMARY RESPONSIBILITY (OPR). F/10
6.
 - a. DTIC APPLICABLE.
 - b. GIDEP APPLICABLE.
7. APPLICATION/INTERRELATIONSHIP

7.1 This Data Item Description (DID) contains the content and format preparation instructions for that data generated by Task 207 of MIL-STD-882C.

7.2 Data items that relate to this Data Item Description are DI-SAFT-80100A, System Safety Program Plan; DI-SAFT-80101A, System Safety Hazard Analysis Report; DI-SAFT-80102A, Safety Assessment Report; DI-SAFT-80103A, Engineering Change Proposal System Safety Report; DI-SAFT-80104A, Waiver or deviation System Safety Report; DI-SAFT-80105A, System Safety Program Progress Report; DI-H-1332A, Radioactive Material Data; DI-H-1327A, Surface Danger Area Data; and DI-H-136, Noise Measurement Report.

8. APPROVAL LIMITATION.

9. a. APPLICABLE FORMS.
- b. AMSC NUMBER. 6868

10. PREPARATION INSTRUCTIONS.

10.1 Source Document. The applicable issue of the documents cited herein, including their approval dates and dates of any applicable amendments and revisions, shall be as reflected in the contract.

10.2 Contents. The Health Hazard Assessment Report (HHAR) shall contain the following:

10.2.1 References. A list of source materials used in preparing the report. Include, for example, government and contractor reports, standards, criteria, technical manuals, and specifications. If references are numerous, put them in a bibliography as an appendix.

10.2.2 System Description. A brief identification of the system and its purpose. Address significant health hazard issues that are identified later in the report.

10.2.3 Background. A description of the system and its intended operation. Include pertinent components or subsystems that contribute most to a health hazard; the identity of the intended users and the type of protective clothing and equipment, if any, available to the user; and a summary of the evaluations or assessments performed on system prototypes or developmental models.

10.2.4 Identification of Health Hazard Issues. A description and discussion of each potential or actual health hazard issue of concern for each subsystem or component. A health hazard is an existing or likely condition, inherent to the operation, maintenance, transport, or use of materiel, that can cause death, injury, acute or chronic

HEALTH HAZARD/HAZARDOUS MATERIAL INFORMATION FOR INPUT INTO THE REQUEST FOR PROPOSAL

illness, disability, or reduced job performance of personnel by exposure to physiological stresses.

Use subparagraphs for each subsystem or component, with additional subparagraphs for each health hazard discussion. Include sufficient detail to clearly define the specific problem, issue involved, and reasoning behind the analyses.

For each proposed and alternative material, include the following:

- a. **Material Identification.** Include material identity, common or trade name, chemical name, chemical abstract service (CAS) number, national stock number (NSN) or local stock number (LSN), physical form (solid, liquid, gas), and manufacturers and suppliers.
- b. **Material Use and Quantity.** Include component name, description, code and/or operations details for the material, total system and program life-cycle quantities to be used; and for mixtures, concentrations for each ingredient.
- c. **Hazard Identification.** The detrimental effects of the material on the system, personnel, environment, or facilities.
- d. **Toxicity Assessment.** A description of the expected frequency, duration, and amount of exposure. Include the reference documentation and methods used to determine potency/toxicity assessment factors and calculations.
- e. **Risk Calculation.** Include classification of severity and probability of occurrence, acceptable levels of risk, any missing information, and discussions of uncertainties in data or calculations.

10.2.5 Assessment of Health Hazard Issues. Include an analysis of data, observations, findings, reports, and other sources of information against health standards and criteria; discussion of the potential effect of the health hazards identified; and an assessment of the risk of the health hazards based on hazard severity and hazard probability as described in MIL-STD-882. Include when the

hazards may be expected under normal or unusual operating or maintenance conditions.

10.2.6 Recommendations. Include a description of the recommended actions that should be taken to eliminate, reduce, or control each actual or potential health hazard described. What is the effect that each action may have on the risk of the health hazard(s).

10.2.7 Summary. Include a summary of the major recommendations.

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DATA ITEM DESCRIPTION

1. IDENTIFICATION NUMBER. To be determined.

2. TITLE. Pollution Prevention Program Plan

3. DESCRIPTION/PURPOSE.

3.1 The Pollution Prevention Program Plan describes the contractor's plans to ensure adequate consideration is given to the elimination, or reduction where elimination is not feasible, of hazardous and environmentally unacceptable materials for the _____, and only for _____ unique system, system components, and associated support items. The emphasis to influence the design by eliminating or reducing hazardous and environmentally unacceptable materials. This ensures proactive pollution prevention management.

3.2 The purpose of the Pollution Prevention Program Plan is to describe the contractor management practices that will eliminate, reduce, or minimize hazardous and environmentally unacceptable materials to incur the lowest possible cost required to ensure protection of human health and the environment.

4. APPROVAL DATE.

5. OFFICE OF PRIMARY RESPONSIBILITY (OPR).

6. a. DTIC APPLICABLE.

b. GIDEP APPLICABLE.

7. APPLICATION/INTERRELATIONSHIP.

7.1 This Data Item Description (DID) contains the content and format preparation instructions for the data product generated by

the specific and discrete task requirements of the program manager (PM) Statement of Work (SOW).

7.2 This data item is related to the PM SOW, _____. Usually, this DID, as set forth in the SOW, are used together to form the basis for all reporting of the Pollution Prevention Program.

7.3 The Pollution Prevention Program is typically required to be developed and/or updated for the Concept Exploration, Demonstration and Validation, Engineering and Manufacturing Development, and Production phases.

8. APPROVAL LIMITATION.

- 9. a. APPLICABLE FORMS.**
- b. AMSC NUMBER.**

10. PREPARATION INSTRUCTIONS.

10.1 Format. The Pollution Prevention Program Plan format shall be contractor selected. Unless effective presentation would be degraded, the initially used format arrangement shall be used for all subsequent submissions.

10.2 General Content. The Pollution Prevention Program Plan shall contain the following:

10.2.1 Index. Identification of the elements of the Pollution Prevention Program Plan correlated to the paragraph and page numbers of the plan.

10.2.2 Definitions and Acronyms.

10.2.2.1 A list with definitions of all unique words, acronyms, and symbols used in the Pollution Prevention Program Plan.

10.2.2.2 A list with definitions of the various categories of hazardous and environmentally unacceptable materials and wastes applicable to the Pollution Prevention Program.

10.2.3 Scope. A comprehensive description of the scope of the Pollution Prevention Program for the system(s), system components, and associated support items correlated specifically to the _____ phase of this acquisition.

10.3 Specific Contents.

10.3.1 Organization.

10.3.1.1 An identification and description of the contractor's Pollution Prevention Program organization using charts to show the organizational and functional relationships and the lines of communication. The identification shall include all organizational elements responsible for executing significant aspects of the Pollution Prevention Program.

10.3.1.2 An identification and description of the responsibility, authority, and accountability of key personnel involved with the contractor's Pollution Prevention Program correlated to their organization element.

10.3.1.3 An identification of the personnel staffing that will be required for the Pollution Prevention Program including the number of personnel and the experience and skill levels required correlated to their organizational element as a function of time.

10.3.2 Program Requirements.

10.3.2.1 A comprehensive description of the program methods and procedures that will be used to accomplish the Pollution Prevention Program requirements for the system(s), system components, and associated support items.

10.3.2.1.1 The description shall include the methods and procedures that will be used to identify and track all hazardous and environmentally unacceptable materials and wastes for the system(s), system components, and associated support items.

10.3.2.1.2 The description shall include the methods and procedures that shall be used to eliminate/reduce identified hazardous and environmentally unacceptable materials and wastes for the system(s), system components, and associated support items.

10.3.2.1.3 The description shall include the methods and procedures (including criteria) that shall be used to prioritize identified hazardous and environmentally unacceptable materials and wastes for the system(s), system components, and associated support items. Those methods and procedures shall be used to identify materials and wastes which have the adverse cost, schedule, or risk impact on the program, and for which a full cost, schedule, and risk analysis shall be performed. The proposal shall include data that shows the projected cost benefits/savings/avoidance to the program if a known material or process substitute/alternative is (or can be) utilized.

10.3.2.2 A description of the management process by which program decisions will be made including the identification and justification of material selections and costs to the government.

10.3.2.3 A description of the procedures that will be used to integrate and coordinate all Pollution Prevention Program efforts including dissemination of the requirements to associated contractors, subcontractors, vendors, and suppliers.

10.3.3 Program Tasks. A complete and comprehensive description of the appropriate accomplishments and criteria that are required to implement an effective Pollution Prevention Program for the system(s), system components, and associated support items for the _____ phase. The plan shall include, as a minimum, narrative descriptions of the approach for identifying and controlling (to

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include substitution when feasible) hazardous and environmentally unacceptable materials and by-products used in the design, manufacture, inspection, maintenance, testing, and disposal. Describe the methodology to be used at some future date, for the integration of the Pollution Prevention Program across all applicable programmatic functions and documentation.

10.3.4 Program Schedule. Identification of all significant Pollution Prevention Program time and event milestones including critical program checkpoints (e.g., reviews, reports) for the system(s), system components, and associated support items for the _____ phase.

10.3.5 Tracking of Materials and Wastes. A description of the tracking system that will be used to track all identified hazardous and environmentally unacceptable materials and wastes throughout the _____ phase of the system, system components, and associated support items.

10.3.6 Hazardous/Environmentally Unacceptable Materials and Wastes Information Dissemination.

10.3.6.1 A description of the means that will be used to disseminate community awareness and emergency information concerning the hazardous/environmentally unacceptable materials and wastes (e.g., handling, storage security, transportation, repair, disposal) of the system, system components, and associated support items.

10.3.6.2 A description of the means that will be used to disseminate community awareness and emergency information concerning the hazardous/environmentally unacceptable materials and wastes when accidents (with emphasis on crash and fire) occur involving the system, system components, and/or associated support items.

10.3.7 Hazardous/Environmentally Unacceptable Materials and Wastes Training. A description of the hazardous materials and wastes training that will be used by the contractor to ensure that all

personnel involved/exposed to hazardous materials and/or wastes will be appropriately trained.

10.3.8 Data. A list and description of all data required to be collected on hazardous and environmentally unacceptable materials and wastes and the means by which it will be recorded, maintained, presented, and/or made available to the government.

10.3.9 Contractual and Legal Requirements. Identification, on an item-by-item basis, of all contractually and legally required Pollution Prevention Program requirements including those requirements contained in regulations for which the contractor must comply. When applicable, the identification shall be cross-referenced to the SOW.

10.3.10 Applicable Documents. A list and description of all key documentation (e.g., government, commercial, contractor, subcontractor, vendor, supplier, possessed, available, or to be acquired by the contractor) for use in the Pollution Prevention Program including a description of the intended use.

10.3.11 Accomplishments. A comprehensive description of the success of the Pollution Prevention Program to include the following:

10.3.11.1 Cost Savings. A complete list of documented and projected costs and cost savings incurred or to be incurred over the life cycle of the system, system components, and associated support items, for all cases where a hazardous or environmentally acceptable material was eliminated, reduced, or minimized.

10.3.11.2 Hazardous Material Reduction. A complete list of documented and projected reductions over the life cycle of the system, system components, and associated support items of hazardous and environmentally unacceptable materials and wastes as a result of the Pollution Prevention Program.

10.3.11.3 Intangible Benefits. List any intangible benefits received as a result of the Pollution Prevention Program that cannot be adequately described as cost savings or as hazardous material reduction (e.g., safer working conditions, increased productivity) that will improve the ability to assess the success of the Pollution Prevention Program.

10.3.12 Recommendations and Conclusions. Identification and description, including the impact, of recommendations and conclusions applicable to the Pollution Prevention Program Plan.

■ *Source for Pollution Prevention Program Plan DID: "Materiel Developer's Guide for Pollution Prevention," HQUSAMC, ATTN: AMCRD-E, Mr. Garcia-Baco, 5001 Eisenhower Avenue, Alexandria, VA 22333-0001.*

**NAS411, Hazardous
Materials Management
Program**

1. HAZARDOUS MATERIALS MANAGEMENT PROGRAM.

1.1 Scope. This NAS411 was created by the Aerospace Industries Association as an industry standard to be applied to U.S. government acquisition of systems, system components, associated support items, and facilities. It applies to all acquisition phases: Concept Exploration, Demonstration and validation, Engineering and Manufacturing Development, Production and Deployment, Operations and Support, and Disposition.

The Hazardous Materials Management Program (HMMP) is the contractor's plan to assure appropriate consideration is given to the elimination/reduction of hazardous materials, and to the proper control of hazardous materials that are not eliminated, for system(s), system components, and associated support items throughout all phases of the system life cycle. The emphasis is on eliminating or reducing hazardous materials early in the design of processes and system products.

This NAS411 shall only be applicable to those contract deliverables that are specifically cited elsewhere in the contract as being subject to this standard.

1.2 Purpose. The purpose of the HMMP is to influence the system and product design process to eliminate, reduce, or minimize hazardous materials, and control hazardous materials in all acquisition phases of a program for the protection of human health and the environment. This is to be accomplished while minimizing system cost and risk to system performance.

1.3 Tailoring. Tasks described in this NAS411 shall be tailored to meet acquisition program requirements. The applicable tasks shall be negotiated with the contractor based upon the requirements of the acquisition phase and size of the program.

1.4 Consistency. Tasks described herein are to be consistently applied across all contractor programs, if appropriate, to allow plant-wide uniformity in practices and processes. The contracting officer shall designate a representative(s) who has the authority to grant waivers or approve deviations from conflicting requirements for alternative processes and materials. Tasks performed after system delivery may be performed on a contract-by-contract basis in accordance with the contract statement of work.

1.5 Compatibility with Existing Regulations. The contractor may satisfy HMMP data requirements by referencing or resubmitting data in the format already required by any regulation or statute. Data requirements that exceed or differ from existing statutory or regulatory requirements shall be subject to the provisions of the "Changes" clause in the contract.

2. DEFINITIONS.

2.1 Acronyms Used in NAS411. The acronyms used in this NAS411 are defined as follows:

- a. DOD Department of Defense
- b. OSHA Occupational Safety and Health Administration
- c. MSDS Material Safety Data Sheet
- d. PM Program Manager
- e. PCO Procuring Contracting Officer
- f. HMMP Hazardous Materials Management Program
- g. SOW Statement of Work
- h. FAR Federal Acquisition Regulation
- i. RFP Request for Proposal
- j. CAS Chemical Abstract Service
- k. ACO Administrative Contracting Officer
- l. CO Contracting Officer
- m. DFARS Defense Federal Acquisition Regulation Supplement

2.2 Definitions. The following definitions apply:

2.2.1 Hazardous Materials. Any material that, due to its chemical, physical, or biologic nature causes safety, public health, or environmental concerns.

2.2.2 Hazardous Materials Management Program (HMMP) Plan. A description of the planned tasks and activities to be used by the contractor to implement the system HMMP. The HMMP is to be used in the context of the management strategy for which improvements may be made to eliminate, minimize, or control hazardous materials.

2.2.3 Contracting Officer (CO). A person with the authority to enter into, administer, and/or terminate contracts on behalf of the government. The Procuring Contracting Officer (PCO) refers to the person at the buying activity who has the authority to enter into contracts. The Administrative Contracting Officer (ACO) refers to the person at the contract administration office, e.g., DPRO, who performs post-award functions.

2.2.4 Hazardous Materials Identification. The process used to identify hazardous materials required for operation and support.

3. GENERAL HAZARDOUS MATERIALS MANAGEMENT PROGRAM REQUIREMENTS.

3.1 HMMP Requirements. The contractor shall conduct a Hazardous Materials Management Program (HMMP), which will include measures for the elimination, reduction, or control of hazardous materials. An HMMP shall be tailored for each acquisition phase of the system as appropriate to the acquisition phase and available funding and consistent with procuring activity projections of the scope and probability of subsequent systems acquisition.

3.2 HMMP Applications. The contractor may apply the HMMP on a plant-wide basis, a contract-specific basis, or a combination of plant-wide and contract-specific.

3.3 Changes and Conflicting Requirements. The contractor shall notify the procuring activity of any changes to the HMMP or conflicts between the HMMP and the other contract requirements, regulations, or statutes. The contractor shall request resolution from the CO in the event of conflicting requirements between the HMMP and local, state, and federal environmental regulations. Any changes to the HMMP shall be subject to the provisions of the "Changes" clause in the contract.

3.4 Approved Plan. The approved HMMP Plan provides the basis of understanding between the contractor and the procuring agency with respect to how the HMMP shall be executed to meet contractual requirements.

4. SPECIFIC HAZARDOUS MATERIAL PROGRAM PLAN REQUIREMENTS.

4.1 Hazardous materials Management Program Plan Proposal Requirement. In accordance with the solicitation, the Preliminary HMMP Plan shall be submitted to the procuring activity as part of the proposal. This preliminary HMMP Plan shall describe an overview of the contractor's HMMP. The successful offeror will provide a full HMMP Plan described in Section 6.2.

4.2 HMMP Objectives. The HMMP Plan shall define the management strategy to systematically eliminate, minimize, or control hazardous materials while maintaining an appropriate balance with performance requirements specified in the contract and the cost of the HMMP. The HMMP Plan shall define the contractor's approach to assure that:

- a. Consideration is given and action defined to affect the deployment, operation, maintenance, transport, and ultimate disposition of the system.

- b. Hazardous materials and processes associated with each contract hardware deliverable item are selectively identified and evaluated based on environmental and health concerns.
- c. Hazardous materials elimination, minimization, or control are considered and detailed in the system design and the manufacturing processes.

4.3 HMMP Plan Tasks. The following tasks will be tailored to reflect the program and acquisition phase:

4.3.1 Organization Structure. The HMMP Plan shall identify and describe organizational and functional relationships and the lines of communication using contractor-specified format. Responsibility for each task shall be described with respect to its organizational element.

4.3.2 Hazardous Materials Identification/Analysis/Evaluation. The HMMP Plan shall define the process the contractor will use to identify the hazardous materials to be addressed on the performance of the contract. The procuring activity may identify and prioritize in the contract the specific hazardous materials for elimination, minimization, or control. The Plan will also identify those hazardous materials that will be selected for reporting under the contract. The Plan will describe the analysis and prioritization techniques to be used to value the risks associated with those identified hazardous materials. The description shall include the contractor's process for material selection and evaluation. The Plan shall also identify the specific information to be provided to the procuring activity as prescribed in Section 6.

4.3.3 Environmental and Health Evaluation. The HMMP Plan shall describe the basis of evaluation and data base(s) to be used for the environmental and health risk evaluation. Where a material to be used falls under the Toxic Substances Control Act Section 5(a) research and development exception, the HMMP Plan shall describe the process and the timing of the process which will be used

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to evaluate potential hazards and communicate these hazards to the contracting agency.

4.3.4 Trade-off Analysis. The HMMP Plan shall define the overall process to:

- Analyze the potential costs associated with trading a hazardous material for a less hazardous material over the life cycle of the product subject to data available at time of delivery.
- Document the trade-off analysis (including cost/benefit analyses) employed for selecting materials and processes.
- Assign responsibility for specific tasks.

4.3.4.1 Trade-off Analysis Documentation and Recommendations. The HMMP Plan shall describe the selection process and criteria to be used for screening hazardous materials. The HMMP Plan shall describe the documentation process to be utilized to establish a record of any trade-off analysis activity and the development of recommendations. This record shall contain the justifications for using a specific material or process, and the reasons for rejecting other materials and processes. The record shall include known potential costs of particular hazardous materials in various phases of military use. The HMMP Plan shall identify the medium by which the contractor will provide this information to the contracting agency.

4.3.4.2 Assignment of Responsibility. The HMMP Plan shall identify the contractor functions with the responsibility to implement actions resulting from the trade-off analysis.

4.3.5 Subcontractor Requirements. The prime contractor shall describe how and to what extent the HMMP requirements will be flowed down to subcontractors.

4.3.6 Milestones. The HMMP Plan shall define significant HMMP milestones and provide an implementation schedule.

4.3.7 Training. The HMMP Plan shall identify the contractor's approach for any specialized training to support the objectives of the HMMP.

4.3.8 Functional Program Integration. The HMMP shall describe the methods and procedures that will be used to integrate and coordinate the HMMP requirements throughout other applicable functional programs and master plans.

5. APPLICATION GUIDANCE.

5.1 Nondevelopmental Items and Commercial Items Acquisitions. The HMMP requirement is not applicable to contracts acquiring nondevelopmental items or commercial items.

6. DATA SUBMITTALS.

6.1 Reporting Requirements. The HMMP Report data submittals shall be submitted as required by the contract activity, e.g., Contract Data Requirements List (CDRL).

6.2 HMMP Plan.

6.2.1 Format. The HMMP Plan format shall be contractor selected.

6.2.2 Table of Contents. Identification of the elements of the HMMP Plan shall be correlated to the paragraph and page numbers of the Plan.

6.2.3 Glossary. The HMMP Plan shall contain a list of definitions of all unique words, acronyms, and symbols used in the Plan.

6.2.4 Scope. The HMMP Plan shall describe the scope of the HMMP for the applicable contract line items in accordance with Section 1.1 herein.

6.2.5 Schedule and Milestones. The HMMP Plan shall describe the HMMP schedule and milestones.

6.2.6 Plan Content Requirements.

6.2.6.1 Contractor HMMP organizational identification, outline, and responsibilities, as described in Section 4.3.1.

6.2.6.2 Methods of hazardous materials identification, analysis, and evaluation, as described in Section 4.3.2.

6.2.6.3 Methods for performing chemical elimination/minimization trade-off analysis, as described in Section 4.3.4.

6.2.6.4 The contractor shall describe the scope and procedures of subcontractor flowdown, as described in Section 4.3.5.

6.2.6.5 Special hazardous materials training requirements, as described in Section 4.3.7.

6.2.6.6 Methods of HMMP integration with other functional programs, as described in Section 4.3.8.

6.3 Report.

6.3.1 Format. The report format shall be contractor selected.

6.3.1.1 In the event of a follow-on contract, the contractor may use the previously submitted HMMP Report as a baseline and show changes made per the follow-on contract so that the HMMP remains a "living document."

6.3.2 Table of Contents. Identification of the elements of the HMMP Plan shall be correlated to the paragraph and page numbers of the Plan.

6.3.3 Glossary. The HMMP Plan shall contain a list of definitions of all unique words, acronyms, and symbols used in the Plan.

6.3.4 Report Content Requirements.

6.3.4.1 Identification of all hazardous materials delivered and required for operation and support to include the following:

- Material Safety Data Sheet.
- Corresponding Specifications and Standards that require the use of the hazardous material.
- Where used in operation and support or within the deliverable item.
- If applicable, at the time of delivery, identify any U.S. statutory phase-outs or bans. As appropriate, the contractor and the procuring activity will negotiate the identification of other worldwide hazardous materials legal considerations.

6.3.4.3 Hazard Evaluation to include the following:

- List of prioritized hazardous materials.
- Basis for priority determination.
- Processes using prioritized hazardous materials.
- Corresponding military process specification.
- Alternative material and process considerations.

6.3.4.4 Trade-Off Analysis as required in 4.3.4 to include the following:

- Cost/Benefit Analysis.
- Itemization of noncost variables affecting trade-off.
- Trade-off analysis conditions and assumptions.
- Hazardous materials and process use recommendations.

■ *Source for National Aerospace Standard NAS411, Hazardous Materials Management Program: Aerospace Industries Association with Army, Navy, and Air Force representatives. Standard provided by DOD Policy Office, LTC Hershell E. Wolfe, 400 Army-Navy Drive, Arlington, VA 22202.*

APPENDIX H

Data Requirements

■ This appendix contains information on some of the health hazard data requirements that the combat and materiel developers will need to address for their given system. These requirements should be incorporated as part of the Test and Evaluation Master Plan, as needed, so that test data may be obtained to address health hazard issues.

1. Combat and materiel developers should be prepared to provide to independent assessors the following required documentation:
 - a. Safety Assessment Reports (SAR).
 - b. Operational Requirements Document (ORD).
 - c. Mission Needs Statement (MNS).
 - d. System MANPRINT Management Plan (SMMP).
 - e. Test and Evaluation Master Plan (TEMP).
 - f. Detailed Test Plan (DTP).
 - g. Acquisition Strategy (AS).
 - h. Independent Evaluation Plan (IEP).
 - i. Integrated Logistic Support Plan (ILSP).
 - j. Technical Testing (TT)/User Testing (UT) Test Reports.
 - k. Program Review Documentation.
 - l. Sampling Data on Test Results (measures of acoustic energy, biological substances, chemical substances,

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oxygen deficiency, radiation energy, shock, temperature extremes and humidity, trauma, vibration, etc.).

m. Record of Environmental Consideration

n. Waste Stream Analysis Report

2. Specific health hazards and impacts that should be considered include:

- a. Chemical hazards (e.g., hazardous materials that are flammable, corrosive, toxic, carcinogens or suspected carcinogens, systemic poisons, asphyxiants including oxygen deficiencies, respiratory irritants, etc.).
- b. Physical hazards (e.g., acoustical energy, heat or cold stress, ionizing and nonionizing radiation).
- c. Biological hazards (e.g., bacteria, fungi, etc.).
- d. Ergonomic hazards (e.g., lifting requirements, task saturation, etc.).
- e. Other hazardous or potentially hazardous materials that may be formed by the introduction of the system or by the manufacture, test, maintenance, or operation of the system.

3. Health hazard points of contact will identify specific test requirements for inclusion in the TEMP. The points of contact will, in conjunction with the materiel developer and the MANPRINT Joint Working Group, develop or specify testing required to ensure health hazard issues are addressed over the entire range of materiel use. Contact the Commander, CHPPM/AEHA, ATTN: MCHB-MO-A, Aberdeen Proving Ground, MD, for initial assistance with data requirements and collection methods.

4. These are some of the health hazard issues that may require data collection and evaluation:

- a. Acoustical energy.

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- Does this system meet the standards for steady-state noise under the most severe operational and maintenance scenarios?
 - Does this system meet the standards for impulse noise under the most severe operational and maintenance scenarios?
 - Does this system meet the standards for blast over pressure under the most severe operational and maintenance scenarios?
- b. Biological substances.
- Does the system configuration preclude exposure to microorganisms, their toxins and enzymes?
- c. Chemical substances.
- Does this system produce or release any toxic substance during maintenance and operation?
 - Are personnel exposed to unacceptable levels of toxic gases or fumes?
 - Are there any unacceptable levels of toxic gases in the crew compartment when the vehicle is operating and/or during weapons firing?
 - Will any materials used decompose or react under extreme heat (pyrolytic) or in the presence of another substance to produce toxic fumes, gases, or vapors?
 - Is the crew effectively/adequately protected against NBC agents?
 - Has each chemical or toxic material used in or with the system been identified in the health hazard assessment report?
 - Does a hazard from exposure to _____ exist?
 - Are personnel adequately protected from fire extinguishing agents?

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- d. Oxygen deficient atmosphere.
 - Is there any potential for an oxygen deficient atmosphere in occupied spaces or compartments?
 - Will occupied spaces contain HALON 1301 automatic fire extinguishing systems which comply with OTSG and NFPA requirements?
- e. Radiation energy.
 - Are there hazards or potential hazardous exposures from ionizing radiation sources during operation, training, and maintenance?
 - Are there hazards or potential hazardous exposures from nonionizing radiation sources during operation, training, and maintenance?
 - Are there hazards or potential hazardous exposures from radiation sources during operation, training, and maintenance?
 - Does the system contain any lasers detrimental to health?
 - Has the system been evaluated for potential radiation health hazards by CHPPM/AEHA per AR 40-5?
- f. Physical hazards.
 - Will this system produce any physical hazards?
 - Is adequate protection provided to preclude trauma to the eyes or body surface during system operation or from personal protective equipment?
 - Does the system meet vibration and shock requirements under all operational conditions?
 - Are there potential hazards from high pressure gases or fluids?
 - Do hazards from excessive dust in crew compartments exist?

DATA REQUIREMENTS

g. Temperature extremes.

- Is there any potential exposure to extreme heat or cold during operation or maintenance that will adversely affect personnel?
- Does the system provide adequate heating, cooling, and ventilation under routine, severe, and emergency conditions?
- Are there any hazards associated with cryogenics?

h. Environmental impacts.

- Are there any environmental impacts associated with the use of this system that later may impair health?
- Are there any health hazards associated with potential environmental contamination during and after use of this equipment?

i. Miscellaneous.

- Have health problems identified with reference systems and components been addressed and abated in this system?
- Are there any health hazards associated with new technologies used to modify or upgrade the system?
- Are health hazards identified during initial and follow-on operational test and evaluation being resolved?
- Does the _____ health hazard due to _____ still exist (for system modification or update)?

5. Data Requirements. Data collection may be required for the following:

- a. Acoustic energy. Use the noise data acquisition guidelines of MIL-STD-1474.
 - Steady-state noise. Provide sound pressure levels, both octave band (unweighted) and overall dBA, at all locations likely to be occupied by personnel. For equipment

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whose noise output varies with operating conditions, include all normally used operating conditions. Define the 85 dBA contour.

- Impulse noise. Provide impulse noise data, to include peak level, dBP, and B-durations, at all locations likely to be occupied by personnel. Define the 140 dBP contour. Evaluation of exposure to extremely high impulse noise levels requires acquisition of additional parameters, as well as dBP and B-duration. Contact USAARL and WRAIR for specific requirements.
 - Operational data. Provide use scenarios sufficient to allow estimation of the noise exposure of personnel. This should include position of personnel relative to the noise source, daily duration of exposure, daily number of rounds, and equipment operating conditions. For certain systems such as mortars, the exact position of the ears are critical and must be provided.
- b. Toxic substances.
- Collect test data to determine the level and duration of personnel exposures to toxic materials. Data should be collected in the breathing zone at all normally occupied positions.
 - Provide detailed information on chemicals and hazardous materials used during the operation, maintenance, etc., of the system. Material Safety Data Sheets, handling procedures, personal protective equipment requirements should be included.
 - Provide detailed information on measures used to control exposures to toxic substances (e.g., substitution, engineering controls, etc.).
 - Where NBC air filtration systems are used to provide protection to shelter mounted systems, provide test data that addresses the effectiveness of the filter system.

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- c. Confined space and ventilation.
 - Provide ventilation system and test data that measures the effectiveness of the system to meet the requirements contained in MIL-STD-1472.
 - Provide details regarding confined space entry requirements used with the system.
- d. Nonionizing radiation—optical radiation.
 - Type of source (e.g., laser, infrared, xenon arc, chemical flash, ultraviolet, etc.).
 - Pulsed or CW. If pulsed, the pulse repetition frequency and pulse width.
 - For nonlaser visible and infrared sources, the approximate color, temperature, electrical input power, reflector size, and source dimensions.
 - For laser sources:
 - Wavelength or wavelengths.
 - Radiant power or energy.
 - Emergent beam diameter.
 - Beam divergence.
 - For all sources, the use of the source and the type of personnel using the source.

The source parameters given above must be verified. Verification will be accomplished by the Laser Microwave Division, CHPPM/AEHA.

- e. Nonionizing radiation—radiofrequency electromagnetic hazards.
 - Technical parameters.
 - System characteristics including, but not limited to, operating frequency, peak and average transmitter power output, safety features, and antenna type, gain, and coverage, both in azimuth and elevation.

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- A theoretical analysis of radiofrequency radiation pattern including power density levels and electric and magnetic fields based on worst-case specifications considering not only operations but also repair and maintenance.
- Radiation evaluation.
 - Measured power density levels are required to validate the analysis and test accessible areas around the radiating system. Radiation measurements will normally be made by CHPPM/AEHA. All measurements will use instruments calibrated at the measured frequency.
 - Evaluation of system radiation safety features.
 - Exposure criteria for both controlled and uncontrolled environments is listed in ANSI C95.1-1991. Other ANSI documents, ANSI C95.2, C95.3, and C95.5, provide criteria for labeling and measuring electromagnetic fields.
- f. Ionizing radiation.
 - Radioactive source specifications:
 - Isotope (e.g., tritium, uranium-238, etc.).
 - Amount of isotope in system.
 - Form of the isotope (gas, liquid, solid).
 - Radioactive source sealed, unsealed, plated, or foil.
 - Evaluation or collection of ionizing radiation exposure data.
 - Verification that x-ray devices meet 21 CFR requirements.
 - Verification that radioactive material sources meet appropriate American national standards.
 - Verification that radioactive material is authorized by a Nuclear Regulatory Commission license or DA authorization.
 - System certification.

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- Development of special operational procedures for production and deployment.
 - Storage and use requirements.
 - Maintenance requirements.
 - Disposal requirements.
 - Any special handling requirement.
- g. Heating and cooling.
- Provide detailed information on the heating and air conditioning systems for personnel use.
 - Provide test data that measures the system's ability to meet the heating and air conditioning requirements contained in MIL-STD-1472.
 - Contact CHPPM/AEHA for assistance with data requirements and collection methods.
- h. Vibration.
- Collect and analyze whole-body vibration data IAW the Health and Safety Exposure Limit contained in MIL-STD-1472 and ISO Standard 2631. Use accelerometer locations representative of personnel positions under operationally valid conditions.
 - Contact the U.S. Army Aeromedical Research Laboratory's Biomechanics Branch for assistance with data requirements and collection methods.
- i. Data requirements for chemical clothing.
- Chemical Substances. Provide the data below to ensure materials used for protective garments will not present a health hazard when used as intended. Recommended toxicity tests for fabric materials proposed for potentially prolonged human skin contact include:
 - Animal Toxicity Studies.

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Primary Dermal Irritation: A study performed to determine the potential of a test substance to cause primary skin irritation in rabbits following a single dermal application. (Study durations are for in-life testing. Reporting time must be allowed.)

Primary Eye Irritation: A study performed to determine the eye irritancy potential of a test substance to rabbits following a single application.

Photochemical Irritation: A study performed to determine the potential of a test substance to cause skin irritation in rabbits when a single topical dose is irradiated with ultraviolet light.

Skin Sensitization: A study performed to determine the potential of a test substance to induce delayed contact hypersensitivity in the guinea pig.

- Human Prophetic Patch Testing: This study must be performed if all of the above animal toxicity studies are negative for irritation or sensitization. A sample of an acceptable study plan may be obtained from the CHPPM/AEHA, ATTN: MCHB-MO-T, Aberdeen Proving Ground MD 21010-5422. The current commercial cost is approximately \$5,000 per material. Three months should be allowed for the performance of the human patch test.
- Alternatives to Toxicity Testing: As an alternative to animal and human toxicity testing, the developer may provide certain certified information obtained from the producer of the finished fabric. The finished product may be fabricated entirely of components which have been safely used commercially where prolonged skin contact has occurred. If such is the case, the producer should provide the commercial background for each component to the developer. That information will be evaluated by this agency to ensure adequacy and completeness in order to waive toxicity testing.

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- Material Safety Data Sheets (MSDS): To aid in a complete evaluation, an MSDS for each component in finished fabric must be provided to all toxicity testing facilities and CHPPM/AEHA by either the manufacturer or the developer.
- Temperature Extremes. Provide heat stress evaluation data below to support future health hazard assessments.
- Parameters that should be specified in the requirements documents to facilitate heat stress evaluation are listed below:
- Mission Factors.
- Uniform worn. Must specify what clothing is to be worn with the chemical protective garment being evaluated. If the protective garment has different configurations of wear, these must be specified.
- Work rate should be specified according to the following: light (172-325 watts), moderate (325-500 watts), and heavy (500-600 watts).

In general, since a heavy work rate will not allow significant discrimination between garments, a moderate work rate is usually specified.

- Environmental Factors.
- Three environmental scenarios are recommended for evaluation purposes involving heat stress: temperate, desert, and jungle climates. Each of these specify certain temperatures and parameters. Other climatic conditions may be specified and they should include the following specific conditions:

Temperature.

Humidity.

Wind speed. Generally, a wind speed of 2.0 miles per hour will yield the most severe heat stress scenario.

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Solar load. Usually specified as no solar load, because experimentally it is difficult to control for solar load accurately.

- Human Factors. Unless otherwise specified, normally hydrated, acclimatized, healthy individuals are assumed to be users.
- Pollution Prevention.
 - Develop a plan to inventory and eliminate hazardous materials associated with the life cycle of the garments.
 - Prepare any required life cycle environmental documents to include appropriate disposal issues.
 - Ensure suitable disposal recommendations are developed and provided to users.
 - Provide data to demonstrate that combustion products of burned garments are not hazardous to human health or the environment.
- Soldier Survivability. Garment testing methodologies and health effect levels need to be developed and accepted by the respective communities.

j. Other data requirements that may be required for evaluation.

- Storage and use requirements.
- Maintenance requirements.
- Facility requirements.
- Disposal requirements.
- Any special handling requirements.

APPENDIX I

Chemical Protective Garment Health Hazard Issues

■ This appendix:

- Provides a brief background of current joint service efforts to develop chemical protective garments.
- Contains information on potential health hazards and guidelines/considerations for chemical protective garments.

■ Source: LTC George Murnyak, Mr. Maurice Weeks, and MAJ David Mukai, CHPPM/AEHA.

There is a joint effort of the four military services to design and develop the next generation of chemical/biological protective garments. Currently, the program includes four Army developmental protective suits. Concepts include sorptive undergarments, chemical protective combat uniforms, and over-garments. These options are being pursued to allow complete mission oriented protective posture (MOPP) and heat strain management flexibility in order to tailor protective levels to mission scenarios and threat (Program Fact Sheet, Joint Service Lightweight Integrated Suit Technology, Program Coordinator, Natick, 21 July 1993). The potential health hazard concerns include:

- Chemical substances.
- Temperature extremes.
- Pollution Prevention.
- Soldier Survivability (chemical agents).

CHEMICAL PROTECTIVE GARMENT HEALTH HAZARD ISSUES

In late FY92, the Army, Marine Corps, Navy, and Air Force committed their chemical/biological protective clothing interests to a joint program. This program will maximize interservice compatibility by designing and developing advanced materiel technologies into the next generation of protective clothing systems. The program objectives are to minimize types of suits in service, maximize economies of scale, and conserve service resources while developing protective clothing systems (Program Fact Sheet, Joint Service Lightweight Integrated Suit Technology, Program Coordinator, Natick, 21 July 1993).

Currently, there are four Army development programs (Memorandum, Subject: Statement of Need—Clothing and Individual Equipment (SN-CIE) Staffing, SATNC-IPS, 27 July 1993):

- Advanced Battledress Overgarment (ABDO).
- Lightweight Chemical-Biological Protective Garment (LCBPG).
- Vapor Protective Flame Resistant Undergarment (VPFRU).
- Aircrew Uniform Integrated Battledress (AUIB) Pre-Planned Product Improvement (P3I), which was renamed Enhanced AUIB.

Health hazard issues associated with the use of these products include:

- Chemical substances (dermal response).
- Temperature extremes (heat stress).
- Pollution Prevention (disposal/storage).
- Soldier Survivability (chemical agents).

Health Hazard Issues

Chemical Substances

The following information provides guidance to the developer of a fabric material to be used by the military. The guidance, based upon professional judgment, is for recommended toxicity testing to be performed for specially impregnated, coated, or formulated fabrics

CHEMICAL PROTECTIVE GARMENT HEALTH HAZARD ISSUES

that involve prolonged skin contact when used as intended. The process by which materials are approved or disapproved for use is designated as a Toxicity Clearance (Army Regulation 40-5, Preventive Medicine, 15 October 1990). The Toxicology Division (MCHB-MO-T) of the CHPPM/AEHA is responsible for completing toxicity clearances for any material which may have prolonged contact with skin.

Toxicity Testing Guidance. Recommended toxicity testing for fabric materials proposed for potentially prolonged human skin contact.

a. *Animal Toxicity Studies.*

- **Primary Dermal Irritation:** A study performed to determine the potential of a test substance to cause primary skin irritation in rabbits following a single dermal application. A sample of an acceptable procedure (Standing Operating Procedures, MCHB-MO-T, Primary Skin Irritation Study in Rabbits) may be obtained from the CHPPM/AEHA, ATTN: MCHB-MO-T, Aberdeen Proving Ground, MD 21010-5422. The approximate cost to perform this two-week study is \$1,800. (Study durations are for in-life testing. Reporting time must be allowed.)
- **Primary Eye Irritation:** A study performed to determine the eye irritancy potential of a test substance to rabbits following a single application. A sample of an acceptable procedure (Standing Operating Procedures, MCHB-MO-T, Primary Eye Irritation Study in Rabbits) may be obtained from the CHPPM/AEHA, ATTN: MCHB-MO-T, Aberdeen Proving Ground, MD 21010-5422. This study should be performed using an artificial sweat extract of the finished material. The approximate cost to perform the 2-week study is \$3,500.
- **Photochemical Irritation:** A study performed to determine the potential of a test substance to cause skin irritation in rabbits when a single topical dose is irradi-

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ated with ultraviolet light. A sample of an acceptable procedure (Standing Operating Procedures, MCHB-MO-T, Photochemical Skin Irritation Study in Rabbits) may be obtained from the CHPPM/AEHA, ATTN: MCHB-MO-T, Aberdeen Proving Ground, MD 21010-5422. The approximate cost of this 2-week study is \$1,900.

- Skin Sensitization: A study performed to determine the potential of a test substance to induce delayed contact hypersensitivity in the guinea pig. A sample of an acceptable procedure (Standing Operating Procedures, MCHB-MO-T, Skin Sensitization Study in Guinea Pigs) may be obtained from the CHPPM/AEHA, ATTN: MCHB-MO-T, Aberdeen Proving Ground, MD 21010-5422. The approximate cost to perform this 5-week study is \$11,200.
- b. *Human Prophetic Patch Testing.* This study must be performed if all of the above animal toxicity studies are negative for irritation or sensitization. A sample of an acceptable study plan [Revised Protocol, MCHB-MO-T, Prophetic Patch Testing (Draize Human Sensitization Test)] may be obtained from the CHPPM/AEHA, ATTN: MCHB-MO-T, Aberdeen Proving Ground, MD 21010-5422. The current commercial cost is approximately \$5,000 per material. Three months should be allowed for the performance of the human patch test.
- c. *Alternatives to Toxicity Testing.* As an alternative to animal and human toxicity testing, the developer may provide certain certified information obtained from the producer of the finished fabric. The finished product may be fabricated entirely of components that have been safely used commercially where prolonged skin contact has occurred. If such is the case, the producer should provide the commercial background for each component to the developer. That information will be evaluated by this agency to ensure adequacy and completeness in order to waive toxicity testing.

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- d. *Material Safety Data Sheets (MSDS)*. To aid in a complete evaluation, an MSDS for each component in finished fabric must be provided to all toxicity testing facilities and CHPPM/AEHA by either the manufacturer or the developer.

Temperature Extremes

1. Because of the generally occlusive nature of protective clothing, heat stress risk is a major consideration in the development of such materiel. The adverse health effects of heat stress, including heat cramps, heat exhaustion, and heatstroke are well known and are discussed below. Heat stress results from the complex interaction of mission, environmental, and human factors.

Heat cramps, heat exhaustion, and heat stroke are some of the more commonly reported heat illnesses (TB MED 507, 25 July 1980, Prevention, Treatment, and Control of Heat Injury). The most serious heat-induced illness is heat stroke because it is life threatening and may result in irreversible injury. Heat exhaustion, in its most serious form, may lead to prostration and serious injuries as well. Heat cramps, while debilitating, are easily reversible if properly and promptly treated. Heat disorders due to excessive heat exposure include electrolyte imbalance, dehydration (if adequate water intake is not maintained), skin rashes, and loss of physical and mental work capacity.

- In hot/dry or hot/wet environments, the most important mechanism for lowering body core temperature is evaporative cooling. Wearing protective clothing, especially MOPP gear, significantly reduces the body's temperature regulating mechanism. The USARIEM Heat Strain Model predicts a risk of light casualties (less than 5%) when core body temperatures reach 39.0 °C (102 °F). Since measuring deep body temperature is impractical for monitoring subject's heat load, the measure of environmental factors that most nearly correlate with deep

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body temperature is required. At the present time, Wet Bulb Globe Temperature (WBGT) Index is the simplest and most suitable technique to evaluate environmental factors.

- Additional physiological stress is added when soldiers, sailors, or airmen are required to wear MOPP gear in training or actual NBC environments. In addition to heat injuries, mission effectiveness can be degraded by performance decrements at elevations in core body temperature less than the elevations that cause heat illness. When MOPP gear is worn during a simulated or actual chemical warfare scenario, personnel receive little cooling from general area ventilation because of the insulation provided by the MOPP gear. The most important mechanism for lowering core body temperature is evaporative cooling (Microclimatic Controlled Tank Crewmen Clothing for Extended Mission Time in Chemical-Biological Environments, TR-85/002L (IPL 305), U.S. Army Natick Research and Development Center, December 1984). The impact of heat stress can be reduced with the aid of microclimatic cooling systems and/or basic heat injury prevention measures (TB MED 507, 25 July 1980, Prevention, Treatment, and Control of Heat Injury; General Procedure for Clothing Evaluation Required in a Health Hazard Assessment (HHA) for Heat Stress, 14 May 1992, USARIEM; Microclimatic Controlled Tank Crewmen Clothing for Extended Mission Time in Chemical-Biological Environments, TR-85/002L (IPL 305), U.S. Army Natick Research and Development Center, December 1984; FM 21-10, Field Hygiene and Sanitation, November 1988).

2. Mission factors include such parameters as uniform to be worn, load carried, terrain to be traversed, and work rate required of the soldier. The significant environmental parameters include temperature, humidity, wind speed, and

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solar load. Human factors such as fitness, hydration status, acclimatization, rest, nutrition, medications being taken, and general health all impact the ultimate heat stress scenario. Because of the complexity of these interactions, data collected to assess heat stress and garment use must account for these factors. Similarly, any requirement documents or statements of need should specify exactly under what conditions the garment is to be considered for evaluation. This is critical to ensure the data and evaluation will be meaningful.

3. Some of the conditions under which chemical protective garments are evaluated are assumed since they are generally standard by convention, but other conditions must be specified. Parameters that should be specified in the requirements documents to facilitate heat stress evaluation are listed below. Users and developers must understand that, if the environment is cool enough, any garment might enable the wearer to perform the mission. Likewise, if the environment/scenario is severe enough, the wearer may quickly become a heat casualty no matter what garment is worn. Data generated under these specified conditions will be expressed in terms of the length of time, known as "stay time," that a person may wear the garment before incurring a heat stress injury. The risk of incurring an injury is related to the soldier, sailor, or airmen's resultant core body temperature after that person has used the garment under the specified conditions for the stay time. The higher the core body temperature, the greater the risk of heat injury. The criteria used to assess the health hazard will be the time required to attain a critical core body temperature.

- a. Mission Factors.

- Uniform worn. Must specify what clothing is to be worn with the chemical protective garment being evaluated, including handwear, headwear, footwear, and garments worn underneath. If the protective garment has different configurations of wear, such as MOPP level, these must be specified.

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- Work rate should be specified according to the following: light (172-325 watts), moderate (325-500 watts), and heavy (500-600 watts) (U.S. Army Research Institute of Environmental Medicine, Technical Note 91-2, Sustaining Health and Performance in the Desert: A Pocket Guide to Environmental Medicine for Operations in Southwest Asia, December 1990). In general, since a heavy work rate will not allow significant discrimination between garments, a moderate work rate is usually specified.
- b. Environmental Factors. Three environmental scenarios—temperate, desert, and jungle climates—are recommended for evaluation purposes involving heat stress. Each of these specify certain temperatures and parameters. Other climatic conditions may be specified and they should include the following specific conditions:
 - *Temperature.*
 - *Humidity.*
 - *Wind speed.* Generally, a minimal wind speed of 2.0 miles per hour will yield the most severe heat stress scenario.
 - *Solar load.* Usually specified as no solar load, because experimentally it is difficult to control for solar load accurately in an environmental chamber.
- c. Human Factors. Unless otherwise specified, normally hydrated, acclimatized, healthy individuals are assumed to be users.

Pollution Prevention

Life cycle environmental issues and the need to plan for disposal options (Executive Order 12856 of August 3, 1993, Federal Compliance With Right-to-Know Laws and Pollution Prevention Requirements; DODI 5000.2, Defense Acquisition Management Policies and Procedures, Part 6 System Safety, Health Hazards, and Environmental Impact, February 1991; DOD 5000.2-M, Defense

CHEMICAL PROTECTIVE GARMENT HEALTH HAZARD ISSUES

Acquisition Management Policies and Procedures, Part 4F Environmental Analysis, February 1991; National Aerospace Standard NAS 411, Hazardous Materials Management Program) are addressed below:

1. Pollution prevention is any reasonable mechanism to successfully avoid, prevent, or reduce pollutant discharges or emissions other than by the traditional method of treating pollution at the discharge end of a pipe or stack. This is a "multimedia" program in that it includes actions to reduce the impact of an operation or activity on the total environment (including air, surface waters, ground waters, or soils) through reduction or elimination of wastes, more efficient use of raw materials or energy, or reduced emissions of toxic materials.
2. Pollution prevention will require a new approach to materiel acquisition. Materiel developers need to assess the impact of the total weapon system (including munitions manufacturing) life cycle environmental impacts and costs so that hazardous substances are not used or produced and pollution is not created.
3. A Hazardous Material Management Program (HMMP) (National Aerospace Standard NAS 411, Hazardous Materials Management Program) is prepared to influence the system and product design process to eliminate, reduce, control, or minimize hazardous materials, and control hazardous materiel in all acquisition phases of a program for the protection of human health and the environment. This is to be accomplished while minimizing system cost and risk to system performance.

Soldier Survivability

The following addresses effectiveness of garments to protect against agent threats.

1. Soldier Survivability has been added as the seventh domain of MANPRINT (Memorandum, Subject: Interim Operating Instructions for the Manpower and Personnel Integration

CHEMICAL PROTECTIVE GARMENT HEALTH HAZARD ISSUES

(MANPRINT) in the System Acquisition Process, DAPE-MR, 23 July 1993). It is defined as the characteristic of soldiers that enable them to withstand or avoid adverse military action (friend or foe), or the effects of natural phenomena, that would result in a loss of life or the loss of capability to continue effectively the performance of the prescribed mission.

2. The purpose of protective garments is to provide a level of protection to soldiers, sailors, or airmen from friendly or enemy NBC agents. Currently, the tests used to determine garment effectiveness fail to provide meaningful predictions of human exposures to likely field concentrations of agents. Efforts are ongoing to develop and improve testing methodologies [Minutes of the Chemical Defense Equipment (CDE) Process Action Team (PAT), Test Methodology and Analysis Working Group, Clothing Sub-Group Meeting, 27 May 1993]. System testing procedures are currently being developed by the U.S. Army's Test and Evaluation Command. To assess the health effects of exposure from these systems tests, total exposure estimates expressed as milligrams/man will be needed.
3. The CDE-PAT Toxicology Subgroup has an ongoing effort to review and summarize available toxicology and exposure data on known chemical agents to define the spectrum of percutaneous exposure levels and health effects.
4. The determination of effectiveness based on comparison of penetration data for different garments is best handled by the testing community and not the medical community [2d Endorsement, CHPPM/AEHA (MCHB-MO-A) 9 January 1993, to Memo, Office of the Surgeon General (DASG-PSP-E), 13 July 1992, Subject: Health Hazard Assessments of Air Permeable Chemical Protective Garments].

APPENDIX J

Health Hazards and Automated Information Systems and Some Training Systems

■ This appendix contains information on potential health hazards and guidelines/considerations for automated information systems and some training systems.

1. Most of the systems are nondevelopmental items using commercial hardware. Potential health hazards include exposures to radiation energy, acoustical energy, chemical substances, and ergonomics-related effects (e.g., back pain, carpal tunnel syndrome, shoulder pain, eye fatigue, leg discomfort, etc.). Health hazards identified by the commercial manufacturers must be included in the workstation end user manual. With properly designed hardware and workstations, the health risk is considered minimal.
2. While commercial information systems do not present a health risk associated with the computer hardware, there may be problems after the system is procured, and the hardware is installed into the work environment at the site. Ergonomic related effects could arise from improperly designed computer workstations. This presents a unique approach to addressing MANPRINT considerations for a system, as health hazards with the "system" are considered minimal; however, once the system is procured and installed, potential ergonomics related effects as described above could arise. These problems are due in part to office furniture which is not designed with people in mind, people not involved, procurement problems, and lack of supervisor awareness.

3. Increasing ergonomic related problems suggest that the Federal Acquisition Regulation (FAR) needs to be amended to include a requirement addressing purchase of ergonomically correct furniture.
4. National Institute for Occupational Safety and Health recommendations for VDT workstations follow on p. J-3; some workplace consideration guidelines are included on pp. J-4, J-5.
5. Waste disposal of toner cartridges for printers may be subject to federal, state, or local laws depending on the composition of the toner powder. The refilling of spent cartridges will in most cases eliminate the need for disposal of multiple cartridges.
6. If Automated Information Systems are placed in a tactical vehicle or mounted shelter in the future, a formal health hazard assessment must be requested from the CHPPM/AEHA, ATTN: MCHB-MO-A, Aberdeen Proving Ground, MD 21010-5422, DSN 584-2925. This is because the information system is now in a system that may have other health hazard exposures.

■ Source: HQDA, OTSG, ATTN: SGPS-PSP, LTC Gary M. Bratt, 5109 Leesburg, Pike, VA 22041-3258.

HEALTH HAZARDS AND AUTOMATED INFORMATION SYSTEMS AND SOME TRAINING SYSTEMS

**NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND
HEALTH RECOMMENDATIONS FOR VDT WORKSTATIONS**

1. VDT workstations should be made as flexible as possible to allow for individual operator control of keyboard and screen height, screen brightness and contrast, leg room, 18"-28" viewing distance, workplace illumination levels (for indirect lighting at workstation), and chair adjustments (seat height, backrest height, and armrests).
2. The VDT screen should be positioned so that the viewing angle is 10 to 20 degrees below the horizontal plane at eye level.
3. Illumination levels should be within 500 to 600 lux, with individual workstation lighting provided for jobs requiring higher levels due to visual demands.
4. Screen glare should be controlled through the use of the following:
 - a. Windows covered with drapes/blinds to limit direct sunlight.
 - b. VDTs positioned properly with respect to overhead lighting and other high luminance sources in work area.
 - c. Glare shield on screen as appropriate.

WORKPLACE DESIGN PRINCIPLES AND CONSIDERATIONS

1. Workplace layout design principles include:

- a. Person should be seated with spine balanced and head balanced on spine, a slight back lean, and supported by chair back.
- b. Chair should have a forward tilting chair pan allowing the person to have an open thigh-torso angle of 110 to 115 degrees while maintaining a neutral body posture.
- c. Person should have relaxed shoulders and upper arms should hang comfortably at their side with forearms and wrists supported and wrists in a neutral position.
- d. Top of screen should be at person's eye level.
- e. Copy stand should be adjacent to VDT display positioned at the same distance, same direction or level.
- f. Primary display should be directly in front of person with secondary display to one side.
- g. Workplace layout should incorporate a wraparound configuration to minimize reach.

2. The ergonomic chair design is the most critical system element. It is the most personal tool a worker has and should incorporate the following:

- a. Seat height and back support should be adjustable.
- b. Seat should be adjustable with forward and backward tilt.
- c. Adjustments should be easy to make while seated.
- d. Seat width should be adequate.
- e. Seat padding should be soft allowing comfortable distribution of sitting pressure with no bottoming out.
- f. Seat shape should be slightly concave, front edge of seat should be rounded.
- g. Seatback should tilt backward easily.

- h. Lumbar support should be padded and preferably adjustable in depth.
 - i. Chairback should provide full back support up to shoulders, arm rests should be short, padded, and adjustable in height.
 - j. Upholstery should be nubby and textured.
 - k. Chair base should have 5 legs.
 - l. Casters should roll but not too easily.
 - m. Seating should produce no pressure on the knees.
 - n. Chair should be preferably antistatic.
3. Wrist rests may be used to partially support weight of arm, reduce fatigue in shoulder, reduce torque in elbow, maintain neutral wrist posture, and prevent wrist abrasion on a sharp desk edge.
4. Footrests, if used, should incorporate an inclined top of 5 to 15 degrees, have a nonskid surface, be heavy enough to remain stationary, be large enough to enable repositioning and support both feet with spacing between, be portable, and adjustable in height or angle.

■ *Source: VDT Workstations: Ergonomics, Health, Safety and Productivity Manual Briefing Charts, University Consortium for Continuing Education, David A. Thompson, Ph.D., Stanford University.*

U. S. A R M Y H E A L T H H A Z A R D A S S E S S M E N T M A N U A L
HEALTH HAZARDS AND AUTOMATED INFORMATION SYSTEMS AND SOME TRAINING SYSTEMS

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APPENDIX K**Pollution Prevention**

■ This appendix provides information pertaining to environmental actions that need to be taken during the acquisition of a system. It can be used by both assessors and developers to ensure that pollution prevention considerations have been adequately integrated with the system acquisition program. The requirements of NEPA, AR 200-2, as well as other known legislative or regulatory policy and guidance, must be included. For more information on addressing pollution prevention in system acquisition, refer to the "Materiel Developer's Guide For Pollution Prevention," which is available from the Army Acquisition Pollution Prevention Support Office, HQ, Army Materiel Command, ATTN: AMCRD-E, Alexandria, VA 22333-0001.

**Pollution Prevention—
Environmental Actions Checklist**

The following checklist represents generic activities that can be used in ensuring that environmental considerations have been adequately integrated with the system acquisition program. By nature, checklists are never all inclusive and should be tailored to meet the needs of the program. The requirements of NEPA, AR 200-2, as well as other known legislative or regulatory policy and guidance, must be included.

**Pre-Milestone 0:
Program Initiation Phase**

1. Plan for the environmental activities that are to occur and the objectives of those activities. Be sure to introduce the concept

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of systems engineering and the environmental objective of that effort.

2. Manage resources.

- a. Determine the number of personnel to accomplish the environmental tasks during this phase, and project the number of personnel needed to accomplish environmental tasks for the Concept Exploration and Definition (CE) Phase.
- b. Assess the capability of the staff and the necessary matrix support and request the necessary funding.
- c. Identify what personnel in the program should have environmental issues as their main assignment.

3. During phase performance:

- a. Initiate the planning for an environmental program.
- b. Influence the *initial* Acquisition Strategy (AS).
- c. Assess lessons learned from similar systems about environmental problems and the identification of pollution and hazardous wastes/materials throughout the entire life cycle of those systems. These problems should be eliminated from the new system during subsequent phases of the acquisition process. The action of documenting and assessing lessons learned will establish an "environmental base line" for the program.
- d. Review relevant elements of DODI 5000.2 and other documents to determine relevant environmental actions. Emphasis should be given to the preliminary identification, evaluation, and elimination of hazards.

4. Influence CE Request for Proposal (RFP)/Scope of Work (SOW).

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- a. Require the formulation of pollution prevention and pollution control plans.
 - b. Initiate the integration of environmental issues into the various functional program plans.
 - c. Identify environmental source selection criteria.
5. Evaluate CE proposals.
- a. Assign personnel to evaluate proposals.
 - b. Determine contractors' responsiveness to pollution prevention/control planning requirements by reviewing:
 - Formal contractor organization for the consideration of environmental issues.
 - Format of environmental trade-off studies.
 - Identification of candidates for additional environmental trade-off studies.
 - Schedule trade-off studies.
 - Completeness of plans and schedule for implementation.
 - Formulation of system engineering design teams, environmental capability, and intent to employ.

**Milestone 0:
Concept Studies Approval**

1. Report initial environmental planning activities to the appropriate milestone decision review authority.
2. Determine the number of personnel to accomplish environmental tasks during the CE phase.
3. Assess the capability of the staff and, if necessary, request additional funding for larger staff or for the contracting of some of the environmental activities.

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Phase 0:
Concept Exploration

4. Costs of the environmental actions required during the CE phase must be an integral part of the program.

1. Review the environmental activities that are to occur and the objectives of those activities.
2. During CE contract performance:
 - a. Data should be developed regarding the specifics of hazardous materials and environmental needs which are being considered for the system and its supporting equipment.
 - b. Review in detail the relevant elements of program master planning documents (develop and integrate environmental issues and concerns).
 - c. Milestone charts and schedules should be developed to include completion dates of required actions such as preliminary hazard analysis; identification, selection, and approval of hazardous materials; and incorporation of various and relevant interfaces of pollution prevention and control requirements with other system development requirements to meet future milestones.
 - d. Initiate planning and action for programmatic environmental analyses and assessments.
 - e. Evaluate contractors' implementation of pollution prevention/control plans and the integration of environmental activities with other functional program activities.
 - f. Evaluate contractors' integration of the environment within system engineering teams.
 - g. Participate in the incremental program reviews.
 - h. Evaluate contractors' analysis of the need for environmental manufacturing technology (MANTECH) or other research, development, test and evaluation (RDT&E)

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projects such as the Small Business Innovation Research (SBIR) program.

- i. Establish procedures for the analysis, documentation, and decision for acceptance for high-risk environmental items.
- j. Establish procedures for conducting hazardous materials analysis and selection of more environmentally acceptable substitutes (or the least hazardous).
- k. Review the update of the AS for environmental sufficiency.
- l. Review the update of functional program plans for environmental sufficiency.
- m. Update the environment base line.

3. Influence the Demonstration and Validation (D/V) RFP/SOW.

- a. Require the initiation of environmental issues and concerns within the functional program requirements/plans.
- b. Require the continuation of environmental representation on the system engineering teams.
- c. Require various environmental trade-off studies that are relative to both peacetime and the surge/mobilization/wartime production aspects. (*Very important from a pollution control/compliance aspect.*)
- d. Require hazardous material trade-off studies that are relative to more environmentally acceptable or less toxic materials and the costs to the program over the life cycle (e.g., handling/treating/disposing of hazardous wastes, personal protective gear/practices, legal protection).
- e. Ensure that pollution prevention/control requirements have been tailored and incorporated into the appropriate Data Item Descriptions (DIDs) cited.
- f. Require other environmental analyses as appropriate.
- g. Require the identification of environmental MANTECH and other RDT&E projects and their applications.

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- h. Require environmentally related critical materials/items impact statement and mitigating initiatives.
 - i. Require the integration of environment issues and concerns into all reviews.
 - j. Require environmental risk management initiatives (tracking, tracking indicators, risk drivers, test program for environmentally high-risk design and manufacturing process prove-out).
 - k. State specifically the environmental criteria and weights that will be a part of the source selection process.
4. Evaluate the D/V proposals.
- a. Assign personnel to evaluate the proposal.
 - b. Determine the contractors' responsiveness to various environmental analyses and functional program requirements and plans.
 - c. Determine the contractors' responsiveness to the system engineering design team requirements.
 - d. Evaluate environmental risks, processes, materials, technology, and risk management.
 - e. Evaluate the alternatives considered for environmental trade-off studies and analyses.
 - f. Evaluate the integration of environmental issues into functional program plans and implementation schedules.
 - g. Evaluate the level of environmental effort for the functional program activities/requirements.

**Milestone 1:
Concept Demonstration
Approval**

1. Ensure that environmental risks are included in the Integrated Program Summary (IPS).
2. Report on environmental considerations and mitigation efforts.

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3. Report on integration of environmental considerations with functional program efforts.
4. Establish the pollution prevention/control exit criteria to be applied to each succeeding milestone. One criterion should be the existence and approval of any high-risk hazardous materials/wastes that cannot be eliminated, mitigated, or accepted subject to the review procedures of the milestone decision authority.
5. Identify D/V resources.
 - a. Determine the number of personnel required to accomplish the environmental tasks during the D/V phase. (*A higher level of activity in evaluating contractor performance may be required*).
 - b. Identify resource requirements for research on environmental controls, protective requirements, risk assessments, hazard analysis, life cycle cost analysis, and the preparation/update of programmatic environmental assessments and analyses.
 - c. Costs will still remain an integral part of the program.

**Phase 1:
Demonstration and
Validation**

1. During this phase, it is important for the program manager and staff to develop explicit and visible plans, adequate resources, and contract requirements for continuing implementation of pollution prevention and control as a part of the remaining portions of the system acquisition life cycle.
2. During D/V contract performance:
 - a. Evaluate contractors' implementation of formal pollution prevention and control plans and the implementation

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of functional program requirements and plans relative to environmental issues.

- b. Evaluate contractors' integration of environmental issues and concerns with the systems engineering effort.
- c. Review the planning and development of decision management documents relative to risk and hazard analysis, etc.
- d. Evaluate the hazardous material considerations incorporated into various trade-off analyses.
- e. Evaluate the contractors' progress on other environmental analyses on a regular basis.
- f. Review and update analysis of environmental cost drivers.
- g. Review and update analysis of environmental MANTECH/ RDT&E requirements.
- h. Review facilities design planning to ensure it includes any specialized hazard control or waste disposal requirements associated with approved hazardous or toxic materials.
- i. Specialized training requirements associated with hazardous materials and wastes should be identified and incorporated into training plans.
- j. Ensure that preliminary environmental analyses (in particular, hazardous/toxic material trade-off studies) are underway and completed before the next milestone.
Where hazardous/toxic materials cannot be eliminated and represent a high risk to the program, plans for necessary approvals should be in place.
- k. Incorporate environmental considerations into the Technical Data Package (TDP) plan and Configuration Management program. Particular attention should be given to ensure that nonapproved hazardous/toxic materials are not written into engineering drawings, specifications, depot maintenance work requirements, technical manuals, etc.
- l. Participate in all incremental program/design reviews.

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- m. Update the environmental considerations in functional program requirements/plans.
- n. Review the update of the AS for environmental efficiency.
- o. Update the environmental base line.

3. Influence the Engineering and Manufacturing Development (EMD) RFP/SOW.

- a. Update the requirements for pollution prevention/control plans and environmental integration with functional programs.
- b. Require continuation of environmental integration with the system engineering design effort.
- c. Require formal reports of environmental analyses, management, and mitigation.
- d. Require the approval of environmental sufficiency in the TDP prior to the end of the EMD.
- e. Require explicit environmental updates to functional program plans.
- f. Require explicit environmental life cycle costs.
- g. Require updates to environmental risk assessments and risk management.
- h. Require the integration of environmental considerations, compliance, risks, and mitigation in the development of alternate designs for surge and mobilization.
- i. State specifically the environmental criteria and weights that will be used in the source selection process.

4. Evaluate the EMD proposal.

- a. Assign personnel to evaluate the proposal.
- b. Determine contractors' responsiveness to the pollution prevention and control and functional program requirements/plans.

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- Environmental management and mitigation systems/ processes.
- Environmental trade-off studies and results.
- Subcontractor programs for pollution prevention/control.
- Facilities layouts relative to specialized hazardous/toxic material and waste handling requirements.
- All pollution prevention/control activity and updates.
- Contractors' schedule for TDP development.
- Environmental technology transfer plans.
- Environmental risk management.
- Environmental integration with program reviews.
- Environmental impact, risk, and mitigation of alternate designs for surge and mobilization.

**Milestone 2:
Development Approval**

1. Programmatic environmental analyses and risks should be updated and included in the IPS.
2. Report on the results of environmental analyses and trade-off studies.
3. Report on the environmental life cycle cost analysis.
4. Report on environmental activities associated with other functional programs.
5. Report on the incorporation of pollution prevention and control requirements into Army training plans and human factors, system safety, supply, and installation planning.
6. Manage EMD resources.

POLLUTION PREVENTION

- a. Determine the number of personnel or matrix support required to accomplish the environmental tasks in EMD.
(There may be a substantial increase in staff, matrix support, and/or contractual efforts to perform the various evaluations, audits, and reviews.)
- b. Establish the funding requirements to ensure the continued implementation of environmental considerations in this phase. The results of environmentally focused MANTECH/RDT&E projects should be completed and appropriately integrated with the purchase of any prototype tooling and pilot production.

**Phase 2:
Engineering and
Manufacturing
Development**

1. Program managers and staff should carefully review pollution prevention and control requirements that were identified and actions called for during prior milestones. Attention should be given to ensure the environmental exit criteria are well understood and met to avoid any adverse decisions at Milestone 3.
2. During EMD contract performance:
 - a. Continue to integrate the environment with critical reviews.
 - b. Closely review the environmental elements of the Integrated Logistics Support Plan (ILSP) and other support documents to ensure that environmental objectives and thresholds are being documented and met.
 - c. Review environmental flow down from major system contractor(s) to subcontractors.
 - d. Ensure that any requirements for environmental permits, training for hazardous material handling, and hazardous waste disposal have been identified and are being planned.

POLLUTION PREVENTION

- e. Ensure that procedures are being developed and will be in place for review of the system hazardous material authorized use list. (*This must be coordinated with the supporting commodity command and the Defense Logistics Agency.*)
- f. Ensure that required controls and disposal systems for previously approved hazardous materials are planned to be complete by the time the system becomes operational.
- g. Ensure that requirements for personal protection equipment and disaster response associated with approved hazardous materials have been identified and are being included in the supply and support equipment elements of the ILSP.
- h. Ensure that precautionary and warning information for manuals, training documents, technical orders or manuals, and other instructional material associated with the system are being planned either by contract or in-house.
- i. Ensure that the programmatic environmental assessments and analyses are being revised and updated.
- j. Formally initiate the environmental elements of the functional program requirements.
- k. Validate the environmental life cycle costs and ensure inclusion in other cost estimates (design-to-cost, could cost, etc.).
- l. Validate alternate design for surge and mobilization against the known compliance issues for available facilities and capacity.
- m. Audit the environmental adequacy of the TDP and update as necessary the environmental considerations in the TDP acquisition plan.
- n. Update the pollution prevention/control plans and the environmental considerations in the functional program requirements/plans.
- o. Update the AS.

POLLUTION PREVENTION

- p. Ensure that all environmental exit criteria are being complied with.
 - q. Update the environmental base line.
3. Influence the production and deployment RFP/SOW.
- a. Require a final pollution prevention/control program plan and schedule.
 - b. State specifically the environmental criteria and weights that will be used in the source selection process.
4. Evaluate the production and deployment proposal.
- a. Assign personnel to evaluate the proposal.
 - b. Evaluate the pollution prevention/control program plan and schedule.
 - Ensure that consideration has been given to postproduction environmental management and support plans, and that the status of hazardous and toxic pollution prevention/control deficiencies will be reviewed and remediated.
 - Ensure that any needed environmental changes resulting from observations made during production and deployment will be identified and evaluated.

**Milestone 3:
Production Approval**

- 1. Ensure that environmental risks, safety, and health hazards are included in the IPS.
- 2. Report on environmental risks and mitigation.
- 3. Report on environmental life cycle costs.

POLLUTION PREVENTION

4. Report on plans for the elimination or reduction of hazardous/toxic materials and the generation of hazardous wastes during the Production and Deployment phase and phase 4, Operations and Support.
5. Manage production resources.
 - a. Determine the number of personnel required to accomplish the monitoring of environmental tasks and RDT&E projects in the Production and Deployment phase.
 - b. All activities in the production phase are procurement funded.

Phase 3: Production and Deployment

1. Establish procedures to ensure that compliance by contractors and using-organizations, with established pollution prevention/control requirements, are being validated.
2. Ensure that consideration is being given to environmental management and support plans, and that the status of pollution prevention/control deficiencies is being identified, reviewed, and remediated.
3. Ensure that any needed environmental changes resulting from observations made during production and deployment are being identified, evaluated, and remediated.

APPENDIX L**Soldier Survivability**

■ This appendix provides some background information on soldier survivability. Soldier survivability has recently been added as the seventh domain of MANPRINT. The Army Research Laboratory (ARL), Survivability and Lethality Assessment Directorate (SLAD), has been tasked to perform survivability assessments. The ARL Human Research and Engineering Directorate (HRED) will provide stress and human performance input to SLAD's Domain Assessment Tool. Additionally, they will minimize redundancy and encourage compatibility between Domain Assessment Criteria (health hazards, system safety, human factors engineering, and soldier survivability) and integrate all domains into a MANPRINT Integration Report. HRED is currently composing a preliminary list of soldier survivability assessment issues and identifying applicable models and assessment tools. Official documents detailing survivability actions and requirements will be published in the near future.

Advanced technology has made warfare extremely fascinating—not just to military leaders, but also to the media and even Hollywood. We must be wary, however, of becoming so mesmerized by new technology that we forget the soldier and, in particular, his or her survivability.

In the wake of Operation Desert Storm, one of the more important lessons learned was that incidents of attack from friendly fire (fratricide) had to be reduced. It was also reaffirmed that increases in enemy detection and recognition capabilities, coupled with the expanding lethality and range of modern weaponry, could seriously limit the ability of the U.S. soldier to survive future battles. The

SOLDIER SURVIVABILITY

Chief of Staff of the Army has stated that the Army cannot accept casualties that can be prevented by proper Research, Development, and Acquisition (RDA). Thus, attention must be focused on soldier survivability.

This concern prompted numerous studies involving organizations throughout the Army, including the Assistant Secretary of the Army (RDA), the U.S. Army Materiel Command, the U.S. Army Training and Doctrine Command, PM Soldier, and PM Survivability. As a result, some gains in soldier survivability, especially antifratricide, are being achieved. Without question, these efforts will benefit the current and future survivability of the soldier on the battlefield.

However, soldier survivability still needs more focused attention. A recent review of materiel acquisition regulations and draft documentation revealed little emphasis is placed directly on soldier survivability. Most of the guidance published on survivability is written with system hardware in mind. The concern with survivability is almost totally focused on the threat as opposed to aiming some of that concern on friendly fire. One has to very broadly interpret the law and regulations to include the soldier as an integral part of the weapon system. So, where is soldier survivability defined?

Many believe that soldier survivability is a subset of system survivability. System survivability has been historically oriented toward hardware survivability—generally accepting the thought that, if the system survives, then the soldier survives. Is this really true? Shouldn't soldier survivability always have a higher priority than system hardware survivability? And how does the dismounted soldier fit in this thinking?

In response to this dilemma, the Army's Deputy Chief of Staff for Personnel (DCSPER) proposed a way to resolve this whole issue—include soldier survivability as a seventh domain in the Army's Manpower and Personnel Integration (MANPRINT) program. This approach would provide written guidance and a means of assessing soldier survivability enhancements being introduced into new materiel and soldier systems.

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As a result of the DCSPER's personal interest, a full integration effort from the point of view of the soldier has begun. The feasibility of implementing this new MANPRINT domain is being evaluated. Soldier survivability, the assessment criteria, and the interaction of MANPRINT agencies with other "Soldier as a System" agencies are being defined. Additionally, test assessments are underway on two acquisition systems—the Land Warrior (The Enhanced Integrated Soldier System (TEISS)) and the Armored Gun System (AGS).

In the meantime, the MANPRINT community, as well as the whole acquisition community, needs to consider soldier survivability as a separate and extremely important element of all military systems and the Army's modernization plans. In order to do so, an interim definition for soldier survivability is provided for consideration and evaluation of systems.

A Proposed Definition

Soldier survivability is that characteristic of soldiers that enables them to withstand (or avoid) adverse military action (both friend and foe) or the effects of natural phenomena that would result in a loss of life or the loss of capability to continue effective performance of the prescribed mission.

Survivability must be achieved without sacrificing the ability of the soldier to perform his mission within constraints. Some realistic trade-offs may be necessary between survivability and other aspects of effectiveness such as reliability, mobility, and lethality. Survivability should not detract from the Army's mission to win a battle.

Survivability is more than vulnerability (a quantitative measure of a soldier's susceptibility to damage) and vulnerability reduction (measures to reduce or eliminate the effects of combat damage mechanisms). Survivability of the soldier is a combination of, but not limited to:

- Reducing the detectability of the soldier.
- Preventing attack on the soldier.

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- Reducing vulnerability.
- Preventing further injury.
- Reducing physical and mental fatigue.

**Reducing the Detectability
of the Soldier**

Every effort must be made to prevent the visual, acoustic, electromagnetic, infrared/thermal, radar, millimeter wave, etc. detection of the individual soldier. Some examples of detectability reduction include the use of low observable technology, mufflers, smoke, training (use of concealment), and doctrine. Reducing detectability must also offer capabilities that allow a friendly soldier to detect an enemy soldier outside the enemy soldier's detection capabilities.

Considered in this evaluation is antifratricide—all efforts to ensure that soldiers (both mounted and dismounted) are not detected as enemies by friendly soldiers and weapon systems. This may be accomplished through the use of Identification of Friend or Foe (IFF) systems, embedded IFF training devices, or situation awareness technology.

**Preventing Attack on the
Soldier**

In spite of all kinds of efforts to avoid detection, some of our soldiers and materiel systems will be identified and fired upon. Once detected, it then becomes increasingly important to prevent enemy soldiers and weapon systems from attacking our soldiers and materiel systems. Some examples of preventing attack are:

- Training (use of cover).
- Designing less bulky equipment (thus, reducing the silhouette).
- Decoys.

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- Warning sensors (for ballistic, nuclear, chemical, biological, or laser attacks).
- Counterattack systems (e.g., quickly returned harassment fire, jammers, and active armor).
- Designing max effective ranges of friendly weapon systems outside the enemy's max effective range.
- Evasive action (moving to cover, moving outside the enemy's effective range).

Antifratricide is also included in this evaluation. Efforts should be made to alert soldiers (both mounted and dismounted) of attacks by friendly weapon systems and possibly give them a means of warding off the attack. Besides IFF transmitting devices, the friendly soldier should be able to shut off a smart minefield or divert the attack path of smart/brilliant munitions.

Reducing Vulnerability

The classic approach to improving the survivability of soldiers and materiel systems has been through efforts to reduce the vulnerability of soldiers and systems to enemy weapon fire. This includes not only protecting the soldier from damage due to traditional threats such as bullets, shrapnel, cutting instruments, blasts, and burns, but also preventing attack from chemical, biological, nuclear, laser, high-powered microwave, and acoustic systems. Additionally, the soldier should be protected from natural phenomena such as temperature extremes or deep water. The mounted soldier has to be considered separately from vehicle vulnerability, since the soldier may be harmed even though the vehicle may not be severely damaged. Some examples of vulnerability reduction measures are:

- Armored compartments for mounted soldiers.
- Fire suppression systems.
- Ballistic protection jackets
- Nonflammable fabrics.

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- Chemical protective clothing.
- Prophylaxis drugs.
- Vaccines.
- Insensitive munitions.
- Visors with tunable laser protection.
- Cooling vests.
- Cold weather clothing.
- Built-in self-inflatable life vests.

Preventing Further Injury

If the soldier is injured, efforts have to be made to maintain the soldier's life, prevent fatal injury or physical disabilities, and evacuate the soldier quickly and efficiently to medical treatment facilities. Examples of casualty reduction measures are:

- First-aid packets.
- Bodily function sensors connected to a vehicle or personal computer/communication system.
- Antidotes.
- Clothing that automatically applies tourniquets where needed.
- Environmental control systems.
- Trauma treatment at the squad/crew level.
- Vehicle on-board life support systems.
- Auto-control systems (artificial intelligence systems that can take control of an aircraft or ground vehicle until it has landed or is behind cover).
- Vehicle escape/evacuation hatches.

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**Reducing Physical and
Mental Fatigue**

Soldiers must receive proper sustenance and be equipped with the clothing and equipment that maintains physical capabilities and enhances mental alertness. Also, vehicle, aircraft, and soldier systems must not increase psychological stress on the soldier. Considerations in this area of survivability include:

- Lightweight protective clothing.
- Highly nutritious rations.
- On-board hygiene systems.
- Vehicle seating that maintains a “buddy” within eyesight.
- Reduced noise levels.
- Crew comfort.
- Chemical protective suits that “breathe.”
- All efforts to reduce anxiety in combat (e.g., human factors engineering considerations, training systems, sensor technologies that provide opportunities to sleep, sleeping pills, and decision aid systems—which can handle a high data rate battle).

Many considerations in this part of survivability are closely interwoven with the other domains of MANPRINT.

Summary

The recent increased concern for soldier survivability has prompted various improvements to doctrine, tactics, training, organization, and materiel systems. The plan to include soldier survivability in the acquisition process as a seventh domain of MANPRINT will complement these improvements. This seventh domain will expand emphasis on all aspects of survivability—reducing the detectability of the soldier, preventing attack on the soldier, reducing vulnerability, preventing further injury, and reducing physical and mental fatigue—for both the mounted and

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dismounted soldier. This will ensure that the soldier will not be forgotten nor neglected as advanced technologies continue to proliferate the battlefield.

■ *Source: LTC Albert A. Sciarretta, ODCSPER, ATTN: DAPE-MR, Washington, DC 20310, DSN: 225-9215/6, COMM: 703/695-9215/6. LTC Sciarretta joined the DCSPER Directorate for MANPRINT in October 1992 as the Chief for MANPRINT Policy, Training and Education. He is currently retired from active duty.*

APPENDIX M

Health Hazard Players and Their Responsibilities

■ This appendix provides information on health hazard players and their responsibilities in addressing health hazards in the materiel acquisition process. It shows the current Army Medical Department (AMEDD) reorganization. The AMEDD is reorganizing and current organizational responsibilities will change. The Surgeon General is dual hatted as Commander, U.S. Army Medical Command, (MEDCOM) and Surgeon General. The Army Environmental Hygiene Agency will form the core of the U.S. Army Center for Health Promotion and Preventive Medicine. Additionally, a concept for improving early involvement and the players involved are included.

1. The Players

AMC Surgeon

Focal point for MATDEV.

CBTDEV

Ensures health hazard issues are addressed in requirement and test documentation and SMMPs.

MATDEV

Ensures that health considerations are addressed throughout the LCSMM, including requirement and test documentation and SMMPs.

HEALTH HAZARD PLAYERS AND THEIR RESPONSIBILITIES

OPTEC/TECOM

Tests and evaluates health features of materiel systems consistent with requirement documents.

Contractor

Builds to specific health hazard design requirements.

Preventive Medicine Activities

Reviews requirement documents and SMMPs and provides MJWG support.

The Surgeon General (TSG)

Army Staff responsibility for health hazard policy.

**U.S. Army Medical Department Center and School
(AMEDD Ctr & School)**

Reviews requirement and testing documents and SMMPs and provides MJWG support.

**U.S. Army Center for Health Promotion and Preventive
Medicine (Provisional)(CHPPM/AEHA)**

Provides technical resources for Health Hazard Assessments (HHA).

U.S. Army Medical Command

Medical responsibilities of the health hazard and MAN-PRINT programs.

**U.S. Army Medical Research Materiel Command
(MRMC)**

Serves as the medical materiel developer and develops biomedical data bases.

**2. MANPRINT and
Health Hazards**

- a. Health hazard issues must be considered early in the life cycle of a system to reduce the potential that systems will

HEALTH HAZARD PLAYERS AND THEIR RESPONSIBILITIES

- be fielded that will impact on the safety and health of the soldier during operation, maintenance, storage, or disposal.
- b. The Army Medical Department is reorganizing and current organizational responsibilities will change. Reorganization was initiated 1 October 1993. The basic reorganization is as depicted in Figure M-1. The Surgeon General will be dual hatted as Commander, MEDCOM and Surgeon General. Missions and functions that were accomplished at the OTSG will be the responsibility of MEDCOM or delegated down to operational activities of MEDCOM.
- c. The Surgeon General shall—
- Exercise primary Department of the Army (DA) staff responsibility for the Health Hazard Assessment Program.
 - Through the MEDCOM, provide consultation and advice on medical aspects of MANPRINT. See AR 40-10 and AR 40-5.
 - Through the MEDCOM, establish and issue all medical policies, health standards, exposure limits, or other policies that relate to exposure of personnel to actual or potential hazards throughout the development and acquisition cycle.
 - Through the MEDCOM, develop the physiological, medical, and health standards data bases needed to support the MANPRINT program.
- d. The Commanding General, MEDCOM shall—
- Through the CHPPM/AEHA (MCHB-MO-A), Aberdeen Proving Ground, MD 21010-5422, prepare system Health hazard Assessment Reports for inclusion in the MANPRINT Integration Report. Provide technical assistance to medical personnel supporting MANPRINT Joint Working Groups and provide medical input to related system acquisition documents. Provide technical assistance to combat and materiel developers.

HEALTH HAZARD PLAYERS AND THEIR RESPONSIBILITIES

- Through the Preventive Medicine Activities at installations, provide reviews of MANPRINT and requirements documents during Concept Exploration and Definition and subsequent phases to identify potential health hazards.
- Through the U.S. Army Medical Department Center and School (HSMC-FCM), Fort Sam Houston, TX 78234-6100, provide reviews of MANPRINT and requirements documents during Concept Exploration and Definition and subsequent phases to identify potential health hazards.
- Through the U.S. Army Medical Department Center and School (HSMC-FCM), as medical combat developer, plan and execute a MANPRINT program for medical (Class VIII) materiel development and acquisition.
- Through the U.S. Army Medical Research Materiel Command (SGRD-PLC), Fort Detrick, Frederick, MD 21702-5010, develop biomedical data bases on the mechanism of human physiological and toxicological responses to military-unique exposures common to many weapon systems. Assist combat and materiel developers in the design and execution of developer sponsored studies to obtain biomedical data required. Prepare Health Hazard Assessment Reports as required in coordination with the CHPPM/AEHA.

**3. Health Hazard
Integration**

**Preprogram Initiation
CBTDEV**

- Identify potential health hazards during the Mission Area Assessment (MAA) process.
- Coordinate MAA findings with the Army Medical Department (AMEDD) to surface data voids (AMEDD Ctr & School—doctrine, MRMC—research).

HEALTH HAZARD PLAYERS AND THEIR RESPONSIBILITIES

- Staff Mission Need Statement (MNS) and Operational Requirement Document (ORD) with AMEDD Ctr & School.
- Include health hazard issues in the SMMP (coordinate with AMEDD Ctr & School and/or Preventive Medicine Activities).

Concept Exploration and Definition Phase

CBTDEV/MATDEV

- Identify health hazard issues in COEA/TEA.
- Staff MNS, ORD, and SMMP with AMEDD Ctr & School.

CBTDEV

- Address health hazard issues in COEA/TEA.
- Staff COEA/TEA with AMEDD Ctr & School.

MATDEV

- Request CHPPM/AEHA perform initial Health Hazard Assessment.
- Include plan to identify, assess, and control health hazards in Test and Evaluation Master Plan (TEMP).
- Staff TEMP with CHPPM/AEHA and/or Preventive Medicine Activities.
- Update SMMP health hazard issues.

Demonstration and Validation Phase

CBTDEV/MATDEV

- Include health hazard issues and criteria in test documentation.
- Integrate health hazard considerations in requirement documents.
- Staff requirement documents with AMEDD Ctr & School.

HEALTH HAZARD PLAYERS AND THEIR RESPONSIBILITIES

MATDEV

- Request CHPPM/AEHA to update the HHA based on Technical Test/User Test (TT/OT) test data.
- Update SMMP health hazards.

Testers

- Develop test design plans outlining requirements for medical data and test support (coordinate with MRMC and CHPPM/AEHA).

Engineering and Manufacturing Development Phase

Testers

- Continue to perform all health hazard responsibilities outlined in Demonstration and Validation.

Production and Deployment Phase

CBTDEV/MATDEV

- Ensure HHA recommendations are incorporated in doctrinal, organizational, maintenance, and training publications.
- Coordinate requirements for postproduction testing with MEDCOM when health hazards exist.

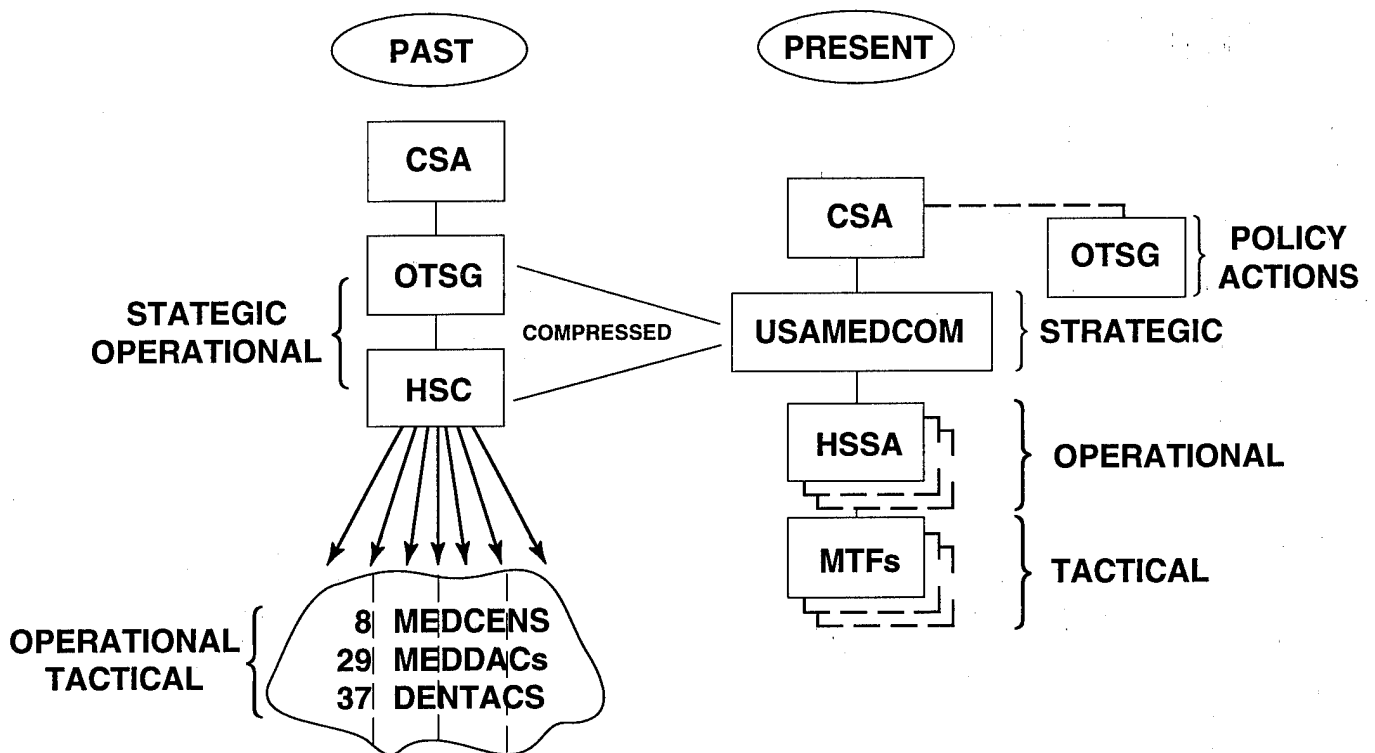
The MANPRINT program is the only method we have in the materiel acquisition process that brings the domains of manpower, personnel, training, system safety, health hazards, human factors engineering, and soldier survivability together under one umbrella.

It is almost impossible to work in one domain area without having some impact on one of the other domains. That is why the "integration" of these domains is so important. Without this integration effort, costly mistakes would be made in terms of equipment design and soldier performance. This integration of the MAN-PRINT domains is the only way to achieve Total System Performance.

■ Source: "Health Hazard Assessment Primer," USAARL Report 90-5, USAARL, ATTN: SGRD-UAS, COL Bruce Leibrecht, Fort Rucker, AL 36362-5292, and HQDA, OTSG, ATTN: SGPS-PSP-E, LTC Gary M. Bratt, 5109 Leesburg Pike, Falls Church, VA 22041-3258.

HEALTH HAZARD PLAYERS AND THEIR RESPONSIBILITIES

AMEDD REORGANIZATION



MEDCOM

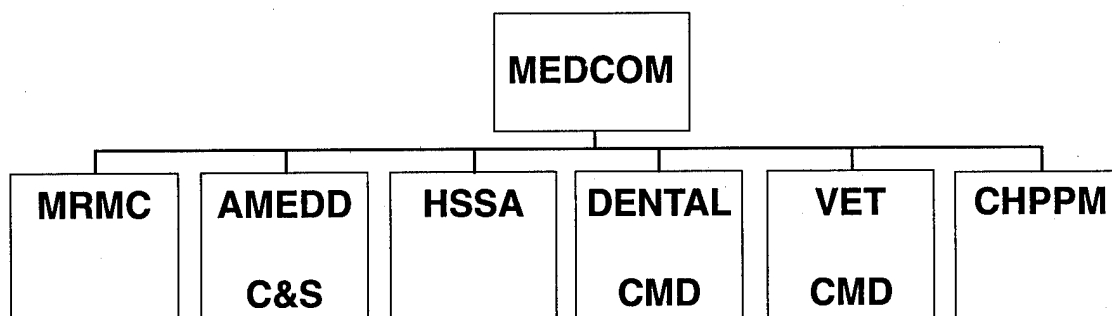


Figure M-1. AMEDD reorganization and MEDCOM

HEALTH HAZARD PLAYERS AND THEIR RESPONSIBILITIES

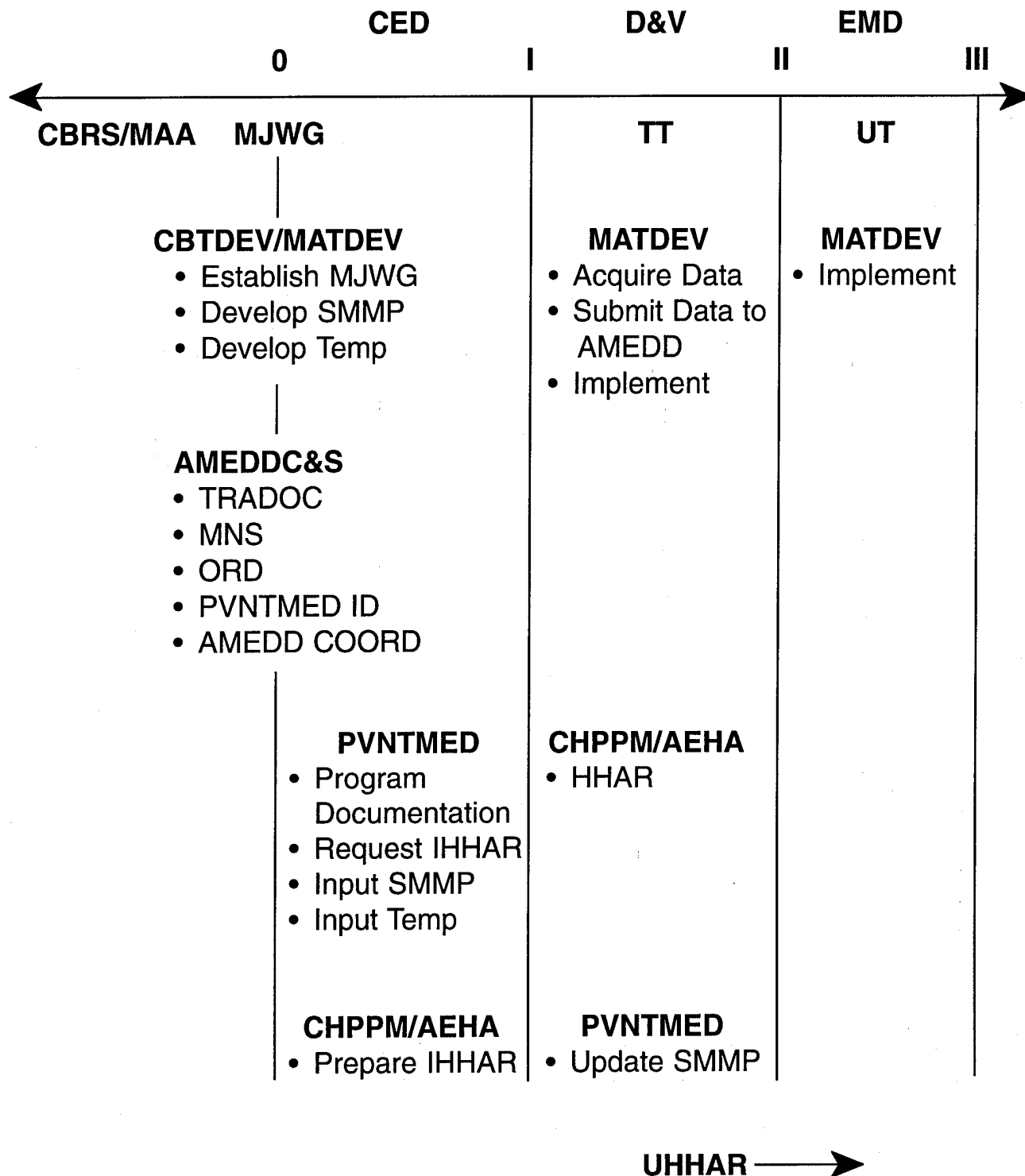


Figure M-2. Concept for improving early involvement

HEALTH HAZARD PLAYERS AND THEIR RESPONSIBILITIES

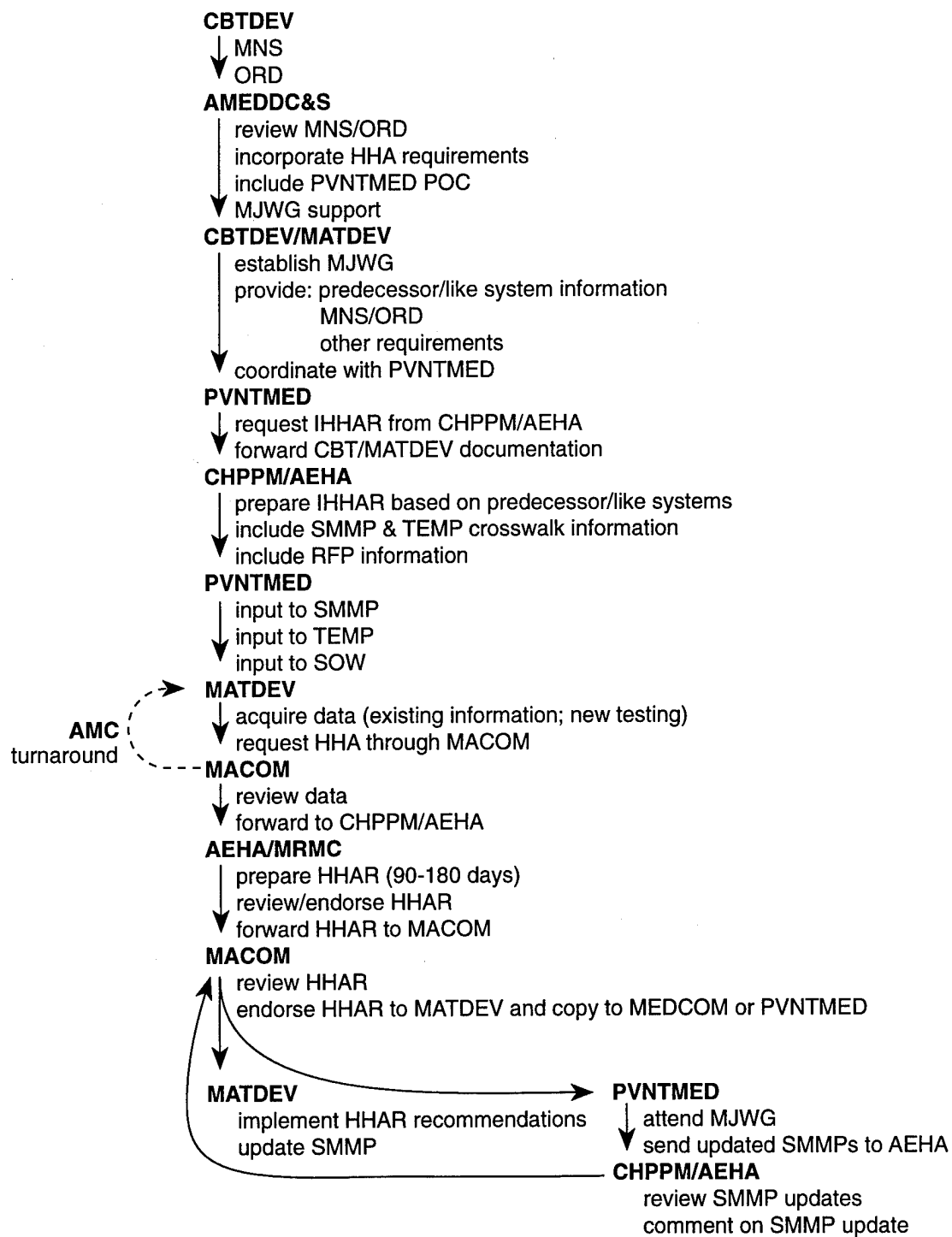


Figure M-3. Data input for SMMPs, TEMP, SOWs, and other requirement documents

HEALTH HAZARD PLAYERS AND THEIR RESPONSIBILITIES

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APPENDIX N

Types of Systems Health Hazards

■ This appendix contains a description of primary systems health hazards. It breaks the hazards into five basic groups:

- Mechanical forces.
- Chemical substances.
- Biological substances.
- Radiation energy.
- Environmental extremes.

These hazards can directly affect soldiers and civilians who operate military systems.

A variety of systems health hazards can directly affect the soldiers who operate military systems. These hazards arise from characteristics of the system and the environment in which it operates. Chemically active substances abound in manufacturing, operating, and maintaining most systems. Normal operation of materiel systems, components, assemblies, etc., produces energy in specific forms—mechanical, electromagnetic, thermal—as well as chemical by-products. In the operational setting, environmental aspects—most notably, temperature extremes, humidity, wind, high altitude, and biological substances—interact intimately with the system and its crew members.

These factors can be organized into five major categories that inventory the primary systems health hazards associated with Army systems, differentiate basic forms, and list generic sources:

TYPES OF SYSTEMS HEALTH HAZARDS

mechanical forces, chemical substances, biological substances, radiation energy, and environmental factors.

Among Army systems, the *mechanical forces* that can injure personnel include acoustical energy (noise), vibration, shock, and trauma. That these hazards tend to occur together is not surprising since they go hand in hand with engines, drive trains, tracks and wheels, transmissions, rotors, guns/cannons, and munitions—components of Army vehicles or aircraft. Outlined in Appendix O, Table O-1, are the basic forms, generic sources, and common system/component sources of each type of mechanical force.

Usually thought of as toxic substances, *chemical substances* are among the most pervasive systems health hazards. Chemically active compounds enter the picture frequently in:

- Basic system construction (e.g., paints, sealants, adhesives).
- Routine operations and logistical support (e.g., fuels, coolants).
- Maintenance (e.g., solvents, cleaning agents).
- Special functions (e.g., fire/flame suppression, decontamination).

Contrasting with these is another family of substances generated by normal system operations, usually by-products of engine combustion and weapons combustion. Of course, the specific fuels and propellants used will influence the by-products encountered, as will a host of other factors. The basic forms in which primary substances and by-products occur—liquids, gases, and solids—guide the summaries in Appendix O, Table O-2.

Biological substances arise mainly from contamination or infiltration of systems by disease-causing microorganisms that reside in the earth's environment. Common types include:

- Bacteria.
- Viruses.

TYPES OF SYSTEMS HEALTH HAZARDS

- Parasites.
- Rickettsia.
- Molds.
- Fungi.

These organisms may grow (or at least survive) wherever there is a "reservoir" containing a hospitable medium, such as water or nutritified liquid. System reservoir examples include:

- Containers, tanks, lines, tubes, compartments, and receptacles where a hospitable liquid may occur, collect, or circulate.
- Systems for processing, handling, storing, transporting, preparing, and dispensing foodstuffs (both solid and liquid forms) and water.
- Medical supplies and biologicals.
- Water supply and distribution equipment.
- Waste disposal equipment.
- Sanitation systems.
- Sewage handling and treatment systems.

The common types of *radiation energy* that accompany Army systems include:

- Visible light.
- Infrared light.
- Ultraviolet light.
- Radiofrequency energy.
- Laser energy.
- Ionizing radiation.

Systems or subsystems designed for special functions, especially of an electrical or electronic nature, most frequently give rise to these types of energy. Appendix O, Table O-3, summarizes the basic forms and generic sources of each type of radiation.

TYPES OF SYSTEMS HEALTH HAZARDS

On the training range and the battlefield, *environmental factors* such as temperature, humidity, wind, and altitude obviously interact with combat systems and their operators. In their extreme forms and combinations, these factors may threaten the soldier's health. In the case of Army materiel, there are three categories of environmental extremes of concern: ambient heat, ambient cold, and oxygen deficiency (see Appendix O, Table O-4).

■ Source: "Health Hazard Assessment Primer," USAARL Report No. 90-5, USAARL, ATTN: SGRD-UAS, LTC Bruce Leibrecht, Fort Rucker, AL 36362-5292.

APPENDIX O

Example Systems Health Hazards and Sources

■ This appendix provides a listing of mechanical, chemical, radiation energy, and environmental extreme health hazards. It is not all inclusive; however, it will provide you with:

- A general idea of specific health hazards.
- The basic forms that are involved.
- The source of the specific hazard.
- Examples of systems that may have these hazards associated with it.

EXAMPLE SYSTEMS HEALTH HAZARDS AND SOURCES

Table O-1

Examples of Systems Health Hazards—Mechanical Forces

Health Hazards	Basic Forms
Noise, steady state	Intermittent Sustained Narrow band Wide band
Noise, impulse	Blast Impact Repetitive Nonrepetitive
Blast, overpressure	Freefield Complex (reverberant) Repetitive Nonrepetitive
Vibration	High frequency Low frequency Linear Rotational Intermittent Sustained
Shock	Acceleration Deceleration Force loading
Trauma	Blunt Sharp Musculoskeletal

EXAMPLE SYSTEMS HEALTH HAZARDS AND SOURCES

Generic Sources	System Sources
Generating, transmitting, and converting power; drive elements interacting with ground or air; electronic reproduction or amplification of sound; gas or fluid flow/friction; steady combustion	Tracked vehicles, wheeled vehicles, self-propelled artillery; aircraft (rotary and fixed wing); communication headsets and speakers; alerting or warning signals; power generators; training simulators; maintenance tools and equipment; gas torches; compressed air/gas
Propellant combustion; detonation of explosives; sudden release of pressure; forceful impact	Pistols, machine guns; grenades; mortars, cannons, tank guns, howitzers; recoilless rifles, rockets, missiles; nuclear warheads; explosives; training simulators; impact tools and equipment
Propellant combustion and detonation of explosives	Mortars, cannons, tank guns, howitzers; recoilless rifles, rockets, missiles, explosives, nuclear warheads
Generating, transmitting, and converting power; drive elements interacting with ground or air; resonance dynamics; induced changes or oscillations in system attitude or position	Tracked vehicles, wheeled vehicles, self-propelled artillery; aircraft (rotary and fixed wing); training simulators; maintenance tools and equipment
System impact (crash, collision, hard landing); system recoil; sudden aircraft displacement due to air turbulence; windblast; parachute opening	Aircraft (rotary and fixed wing); wheeled vehicles, tracked vehicles, self-propelled artillery; parachute systems
Objects or components impacting soldier; weapons blast; weapons recoil; vehicle/terrain interaction; airblast; musculoskeletal overload	Tracked vehicles, wheeled vehicles; artillery (towed, self-propelled); tank guns; aircraft (rotary and fixed wing); hand-held guns, shoulder fired rockets/missiles; maintenance tools and equipment; compressed air/gas; explosive training devices; excessive operator force/exertion

■ Source: "Health Hazard Assessment Primer," USAARL Report No. 90-5, USAARL, ATTN: SGRD-UAS, COL Bruce Leibrecht, Fort Rucker, AL 36362-5292.

EXAMPLE SYSTEMS HEALTH HAZARDS AND SOURCES

Table O-2

Examples of Systems Health Hazards—Chemical Substances

Health Hazards	Basic Forms
Liquids*	Mists Aerosols
Gases and vapors	
Solids	Coatings Aerosols Fumes Dusts Particulates

* Common types of liquids include fuels, lubricants, coolants, hydraulic fluids, solvents, cleaning agents, paints, adhesives, pesticides, herbicides, defoliants, and decontamination solutions.

EXAMPLE SYSTEMS HEALTH HAZARDS AND SOURCES

Generic Sources	System Sources
Fueling, maintaining, and repairing systems; systems salvage and disposal; pest and plant control; decontamination; generation of obscurants; sewage handling and treatment	Systems incorporating combustion engines (piston, turbine), hydraulics, air conditioners; systems for handling, storing, and transporting fuels and other petroleum products; maintenance shop; paint shop; repair shop; sewage handling and treatment systems; systems for handling, storing, transporting, and dispensing pesticides, herbicides, and defoliants; decontamination systems; fog oil generators
Vaporization of liquids or solids; engine combustion; weapons combustion; compressed gas; air filtration; electric motors; welding; flame/fire suppression	Systems incorporating combustion engines (piston, turbine), hydraulics, air conditioners; systems for handling, storing, and transporting fuels and other petroleum products; maintenance shop; repair shop; paint shop; gas torches; machine guns, tank guns, cannons, mortars, howitzers, recoilless rifles, rockets, missiles; gaseous fire suppression systems (e.g., Halon); systems for handling, storing, transporting, and dispensing pesticides, herbicides, and defoliants; sewage handling and treatment systems; compressed gas systems and containers; liquid decontamination systems; protective filters
System/environment interaction; burning materials; generation of smokes/obscurants; construction activities; blasting; welding, brazing, soldering; cutting, grinding, and sanding of metals, plastics, wood; decontamination; pest and plant control; air filtration	Tracked vehicles; wheeled vehicles; aircraft (rotary and fixed wing); artillery (towed, self-propelled); munitions; explosives; smoke/obscurant systems; construction equipment; maintenance shop; paint shop; repair shop; power saws, grinders, sanders; welding, brazing, and soldering equipment; powder-form decontamination systems; systems for handling, storing, transporting, and dispensing pesticide and herbicide dusts; protective filters

■ Source: "Health Hazard Assessment Primer," USAARL Report No. 90-5, USAARL, ATTN: SGRD-UAS, COL Bruce Leibrecht, Fort Rucker, AL 36362-5292.

EXAMPLE SYSTEMS HEALTH HAZARDS AND SOURCES

Table O-3

Examples of Systems Health Hazards—Radiation Energy

Health Hazards	Basic Forms
Radiofrequency energy	Microwaves Millimeter waves Transient Sustained
Infrared	Sustained Transient
Visible light, high intensity	Artificial Natural Transient Sustained
Ultraviolet	Near UV Far UV Artificial Natural Transient Sustained
Laser energy	Pulsed Transient Sustained
Ionizing radiation	Transient Sustained

EXAMPLE SYSTEMS HEALTH HAZARDS AND SOURCES

Generic/System Sources

Telecommunications systems; radar systems; microwave ovens

Heating elements (such as those used in food preparation equipment and space heaters); gas torches; soldering equipment; electronic repair equipment

Search lights; landing lights; strobes; high-intensity lamps; light amplification devices; cathode ray tubes; natural sunlight; highly reflective surfaces; laser reflection; gas torches; nuclear flash

UV lamps; gas torches; gas discharge tubes; natural sunlight (varies with season, altitude, etc.)

Rangefinders; target designators; training simulators; sensor-targeted countermeasure systems; material processing systems

High-voltage electronics; x-ray equipment; radioluminescent materials; nuclear weapons; depleted uranium munitions

■ Source: "Health Hazard Assessment Primer," USAARL Report No. 90-5, USAARL, ATTN: SGRD-UAS, COL Bruce Leibrecht, Fort Rucker, AL 36362-5292.

EXAMPLE SYSTEMS HEALTH HAZARDS AND SOURCES

Table O-4

Examples of Systems Health Hazards—Environmental Factors

Health Hazards	Basic Forms	Generic Sources
Ambient heat	Convective Radiant Natural Artificial Transient Sustained	Environmental heat; sunlight; heat-generating systems and subsystems; human metabolism
Ambient cold	Natural Artificial Transient Sustained	Environmental cold, ice; cooling subsystems
Oxygen deficiency	Natural Artificial Transient Sustained	High altitude (terrestrial, airborne); oxygen displacement in confined places; systems that constrain breathing

EXAMPLE SYSTEMS HEALTH HAZARDS AND SOURCES

System Sources	Contributing Factors
Tracked vehicles, wheeled vehicles; self-propelled artillery; aircraft (rotary and fixed wing); cannons, guns, rockets, missiles (as components of systems with enclosed crew compartments); training simulators; collective shelters; protective clothing, helmets, masks, respirators, gloves, boots; food preparation equipment; heaters; lamps; electrical/electronic equipment	Humidity; wind; clothing; workload
Tracked vehicles, wheeled vehicles; self-propelled artillery; aircraft (rotary and fixed wing); systems/subsystems for air conditioning, refrigeration and frozen storage; training simulators; collective shelters	Humidity; moisture; wind; clothing; workload
Aircraft (rotary and fixed wing); airborne operations; high-altitude operations; altitude chamber; gaseous suppression systems; protective masks; respirators	Workload; ambient temperature; engine combustion fumes; weapons combustion fumes; fuel vapors

■ Source: "Health Hazard Assessment Primer," USAARL Report No. 90-5, USAARL, ATTN: SGRD-UAS, COL Bruce Leibrecht, Fort Rucker, AL 36362-5292.

EXAMPLE SYSTEMS HEALTH HAZARDS AND SOURCES

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APPENDIX P

Life Cycle System Management Models

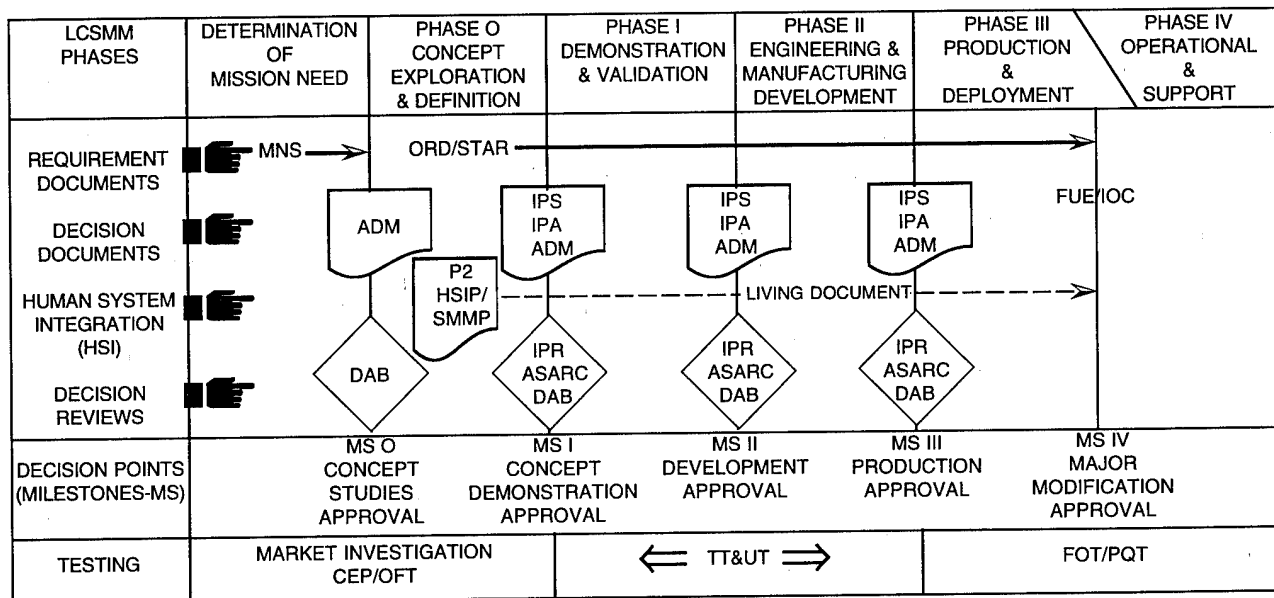
■ This appendix provides a life cycle system management overview and an overview in chart form of System Acquisition Life Cycle Models (Army System Acquisition Review Council for Major Materiel Systems and Major Automated Information System Review Council for Major Automated Information Systems). While these charts are primarily for use with Acquisition Category I/II systems, the same general procedures occur for most all nonmajor Army systems. The acquisition of a system may not follow this completely, but it provides the phases of development and milestone decision points that must be passed. Wherever "MANPRINT" or "Human Systems Integration" is indicated within the charts, "Health Hazards," "Soldier Survivability," and "Pollution Prevention" should be addressed. The ASARC and MAISRC charts are available from the U.S. Government Printing Office. The number for the charts is 1992-322-554.

■ *Source: PERSCOM, DCSPI, ATTN: TAPC-PLM, Mr. Jan Dykuis and Ms. Diana Luker; Army Logistics Management College, ATTN: AMXMC-ACM-MA, Mr. Jim Walsh.*

LIFE CYCLE SYSTEM MANAGEMENT MODELS

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L I F E C Y C L E S Y S T E M M A N A G E M E N T M O D E L S



ADM - ACQUISITION DECISION MEMORANDUM
 ASARC - ARMY SYSTEM ACQUISITION REVIEW COUNCIL
 CEP - CONCEPT EVALUATION PROGRAM
 DAB - DEFENSE ACQUISITION BOARD
 FOT - FOLLOW-ON OPERATIONAL TEST
 FUE - FIRST UNIT EQUIPPED
 HSIP - HUMAN SYSTEMS INTEGRATION PLAN
 IOC - INITIAL OPERATIONAL CAPABILITY
 IPA - INTEGRATED PROGRAM ASSESSMENT
 IPR - IN PROCESS REVIEW
 IPS - INTEGRATED PROGRAM SUMMARY

MAA - MISSION AREA ANALYSIS
 MNS - MISSION NEED STATEMENT
 OFT - OPERATIONAL FEASIBILITY TEST
 ORD - OPERATIONAL REQUIREMENTS DOCUMENT
 P2 - POLLUTION PREVENTION
 PDM - PROGRAM DECISION MEMORANDUM
 PQT - PRODUCTION QUALIFICATION TEST
 SMMP - SYSTEM MANPRINT MANAGEMENT PLAN
 STAR - SYSTEM THREAT ASSESSMENT
 TT - TECHNICAL TESTS
 UT - USER TEST

Figure P-1. Life cycle system management model overview



Figure P-2. ASARC process



LIFE CYCLE SYSTEM MANAGEMENT MODELS

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APPENDIX Q

References

■ This appendix contains a listing of commonly used publications that are used by independent assessors and others involved with the Army Acquisition Process and evaluating health hazards of Army systems. Some of the documents will help provide you with an understanding of the acquisition process, while other documents will help provide you with the source documents for criteria that are used.

1. American Conference of Governmental Industrial Hygienists (ACGIH), *Documentation of the Threshold Limit Values (TLVs) and Biological Exposure Indices (BEIs)*, current edition, ACGIH, Cincinnati, Ohio, with Supplemental Documentation.
2. ACGIH, *Industrial Ventilation, A Manual of Recommended Practice*, current edition, Cincinnati, Ohio.
3. ACGIH, *TLVs and BEIs*, current edition, Cincinnati, Ohio.
4. American Industrial Hygiene Association (AIHA), *Engineering Field Reference Manual*, AIHA, Akron, Ohio.
5. American National Standards Institute (ANSI) Standard C95.2-1981, *Radio Frequency Radiation Hazard Warning Symbol*; reaffirmed in 1989.
6. ANSI C95.3-1973, *IEEE Standard Techniques and Instrumentation for the Measurement of Potentially Hazardous Electromagnetic Radiation at Microwave Frequencies*; reaffirmed in 1979.

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8. ANSI C95.5-1981, *Recommended Practice for the Measurement of Hazardous Electromagnetic Fields—RF and Microwave*.
9. ANSI S3-18, *Guide for the Evaluation of Human Exposure to Whole-Body Vibration*, 1979.
10. ANSI Z87.1-1979, *Practice for Occupational and Educational Eye and Face Protection*, ANSI, Inc., New York, New York, 1979.
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14. ANSI Z358.1-1990, *Emergency Eyewash and Shower Equipment*, ANSI, Inc., New York, New York, 1990.
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17. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 55-1981, *Thermal Environmental Conditions for Human Occupancy*, ASHRAE, Inc., Atlanta, Georgia.
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22. Army Regulation (AR) 5-11, *Army Model Improvement Program*.
23. AR 11-2, *Internal Management Control*.
24. AR 11-34, 15 February 1990, *Respiratory Protection Program*.
25. AR 25-3, *Army Life Cycle Management of Information Systems*.
26. AR 25-400-2, *The Modern Army Record Keeping System (MARKS)*.
27. AR 40-5, 15 October 1990, *Preventive Medicine*.
28. AR 40-10, *Health Hazard Assessment Program in Support of the Army Materiel Acquisition Decision Process*.
29. AR 40-14, *Control and Recording Procedures for Exposure to Ionizing Radiation and Radioactive Materials*.
30. AR 40-46, *Control of Health Hazards from Lasers and Other High Optical Sources*.
31. AR 40-60, *Policies and Procedures for the Acquisition of Medical Materiel*.
32. AR 50-6, 15 January 1984, *Chemical Surety Program*.
33. AR 70-1, *Systems Acquisition Policy*, April 1992.
34. AR 70-6, *Management of the Research, Development, Test and Evaluation Army Appropriation*.
35. AR 70-8, *Soldier-Oriented Research and Development in Personnel and Training*.
36. AR 70-10, *Test and Evaluation During Development and Acquisition of Materiel*.
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40. AR 71-2, *Basis of Issue Plans (BOIP), Qualitative and Quantitative Personnel Requirements Information (QQPRI).*
41. AR 71-3, *User Testing.*
42. AR 71-9, *Materiel Objectives and Requirements.*
43. AR 73-1, *Test and Evaluation Policy.*
44. AR 200-1, *Environmental Protection and Enhancement*, April 1990.
45. AR 200-2, *Environmental Effects of Army Actions*, December 1988.
46. AR 350-10, *Management of Army Individual Training Requirements and Resources.*
47. AR 350-35, *Army Modernization Training.*
48. AR 350-38, *Training Device Policies and Procedures.*
49. AR 381-11, *Threat Support to U.S. Army Force, Combat and Materiel Development.*
50. AR 385-9, *Safety Requirements for Military Lasers.*
51. AR 385-10, 23 June 1988, *The Army Safety Program.*
52. AR 385-11, 1 May 1980, *Ionizing Radiation Protection.*
53. AR 385-16, *Systems Safety Engineering and Management.*
54. AR 385-30, 15 September 1983, *Safety Color Code Markings and Signs.*
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63. AR 600-68, 17 November 1987, *Army Health Promotion*.
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66. AR 700-68, 2 September 1971, *Storage and Handling of Compressed Gases and Gas Cylinders*.
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NOTE: Specific years of some publications are intentionally left blank due to periodic updating by the responsible organization. The users of this list of standard references are reminded to acquire the latest edition of the particular publication to remain current with state-of-the-art information.

APPENDIX R

Glossary of Acronyms and Abbreviations

■ This appendix contains a listing of commonly used acronyms/abbreviations within the materiel acquisition community, provided by program managers in the Army acquisition community. The use of acronyms/abbreviations in documents and in speaking is widespread and a common part of the acquisition language. If you don't understand the communication, you may become confused about what is being discussed. This glossary is intended to provide you assistance in better understanding what you are reading or hearing.

AA	Aptitude Area, Active Army, Armored Ambulance or Abbreviated Analysis (obsolete)
AADSACS	Army Air Defense Surveillance and Control System
AAE	Army Acquisition Executive
AAMMH	Annual Available Maintenance Man Hours
AAPPSO	U.S. Army Acquisition Pollution Prevention Support Office
AO	Operational Availability
A2C2	Army Airspace Command and Control
ABCA	American, British, Canadian, and Australian
ABDO	Advanced Battledress Overgarment
ABIC	Army Battlefield Interface Concept
ABMOC	Air Battle Management Operations Center
ABOIPFD	Amended Basis of Issue Plan Feeder Data
ACAT	Acquisition Category

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

AC of S	Army Chief of Staff
ACCS	Army Command and Control System
ACD	Army Candidate Depots
ACGIH	American Conference of Governmental Industrial Hygienists
ACIS	Army Combat Identification Systems
ACR	Armored Cavalry Regiment
ACRMP	Automation and Communication Resource Management Plan
ACRWG	Automation Communications Resources Work Group
ACS	Attitude Control System
ACUS	Army Common User System
AD	Air Defense
ADA	Air Defense Artillery
ADAP	Army Designated Acquisition Program
ADATD	Air Defense Artillery Test Directorate
ADCCS	Air Defense Command and Control Systems
ADDS	Army Data Distribution System
ADDSI	Army Data Distribution System Interface
ADEA	Army Development and Employment Agency
ADM	Acquisition Decision Memorandum
ADP	Automatic Data Processing
ADPE	Automatic Data Processing Equipment
ADR	Air Defense Reticle
ADV DEV	Advanced Development
ADW	Air Defense Warning
AEHA	U.S. Army Environmental Hygiene Agency

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

AEI	Armor Enhancement Initiative
AEL	Adverse Effect Level
AEP	Allied Engineering Publication
AES	ATCCS Experimentation Site
AFATDS	Advanced Field Artillery Tactical Data System
AFAS	Advanced Field Artillery System
AFCCC	Air Force Component Command Center
AFLC	Air Force Logistics Command
AFNMD	Air Force National Missile Defense
AFQT	Armed Forces Qualification Test
AFSC	Air Force Systems Command
AFSPACECOM	Air Force Space Command
AFV	Armored Family of Vehicles
AGS	Armored Gun System
AIN	Army Interoperability Network
AIS	Automated Information System
AITC	Army Interoperability Test Center
ALDT	Administrative and Logistics Downtime
ALMC	U.S. Army Logistics Management College
ALTS	Automatic Laser Tracker System
AMC	Army Materiel Command
AMDF	Army Master Data File
AMEC	Army Management Engineering College
AMEDD	Army Medical Department
AMEDDC&S	Army Medical Department Center and School

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

AMIM	Army Modernization Information Memorandum
AMMDB	Army MARC Maintenance Data Base
AMMH	Annual Maintenance Manhours
AMMS	Acquisition Management Milestone System
AMSAA	Army Materiel Systems Analysis Activity
AMSDL	Acquisition Management Systems and Data Requirements List
AMV	Armored Maintenance Vehicle
ANCOC	Advanced Noncommissioned Officers' Course
ANMD	Army National Missile Defense
ANSI/MIL STD	American National Standards Institute Military Standard
Ao	Operational Availability
AO	Area of Operations
AOA	Abbreviated Operational Assessment
AOAP	Army Oil Analysis Program
AOC	Area of Concentration
AOSP	Army Occupational Survey Program
AP	Acquisition Plan
APB	Acquisition Program Baseline
APG	Aberdeen Proving Ground
APIU	Adaptable Programmable Interface Unit
APS	Aerial Platform Sensor
AQMDs	Air Quality Management Districts
AR	Army Regulation
ARBMDCC	Army Alternate Ballistic Missile Defense Command Center
ARCSIP	Automated Requirements Computation System for Initial Provisioning Model

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ARDEC	U.S. Army Armament Research, Development, and Engineering Center
ARCCC	Army Component Command Center
ARI	U.S. Army Research Institute for the Behavioral and Social Sciences
ARL-HRED	U.S. Army Research Laboratory-Human Research and Engineering Directorate
ARM	Anti-Radiation Missile
ARNG	Army National Guard
ARPRINT	Army Program for Individual Training
ARSPOC	Army Space Operations Center
AS	Acquisition Strategy
ASA	Assistant Secretary of the Army
ASAP	Army Streamlined Acquisition Plan (obsolete)
ASARC	Army Systems Acquisition Review Council
ASAS	All Source Analysis System
ASAT	Antisatellite
ASI	Additional Skill Identifier
ASIOE	Associated Support Items of Equipment
ASL	Authorized Stockage List <i>or</i> Atmospheric Sciences Laboratory
ASM	Armored Systems Modernization
ASMIS	Army Safety Management Information System
ASVAB	Armed Services Vocational Aptitude Battery
ATAC	Advanced Tactical Cannon System
ATC	Air Traffic Control
ATCCS	Army Tactical Command and Control System

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ATDS	Airborne Tactical Data System
ATE	Automatic Test Equipment
ATM	Air Traffic Management
ATMD	Army Theater Missile Defense
ATTD	Advanced Technology Transition Demonstrator
ATP	Authority to Proceed
ATV	Advanced Technology Validation
AV	Aviation <i>or</i> Air Vehicle
AVLB	Armored Vehicle Launched Bridge
AWACS	Airborne Warning and Control System
B2C2	Battalion and Below Command and Control
B5s	Computer Program Development Specs
BAS	Battalion Aid Station
BCA	Baseline Concept Analysis
BCE	Baseline Cost Estimate
BDAR	Battle Damage Assessment and Repair
BDE	Brigade
BE	Brilliant Eyes
BESS	BIT Error Sensing System
BFA	Battlefield Functional Area
BFACS	Battlefield Functional Area Control System
BFV	Bradley Fighting Vehicle
BII	Basic Issue Item
BIT	Built-in Test

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

BITE	Built-in Test Equipment
BM	Battle Management
BM/C3	Battle Management/Command, Control, and Communications
BMD	Ballistic Missile Defense
BMDOC	BMD Operations Center
BMGT	Battle Management
BMO	Ballistic Missile Office
BN	Battalion
BNCO	Basic Noncommissioned Officer's Course
BOIP	Basis of Issue Plan
BOIPFD	Basis of Issue Plan Feeder Data
BOP	Blast Overpressure
BP	Brilliant Pebbles
BRDEC	Belvoir Research Development and Engineering Center
BSFV	Bradley Stinger Fighting Vehicle
BSM	Basic Sustainment Materiel
BSTE	Base Shop Test Equipment
BSTF	Base Shop Test Facility
BTA	Best Technical Approach
BTU/HR	British Thermal Units Per Hour
C2 (or C2)	Command and Control
C2I (or C2I)	Command, Control, and Intelligence
C2E	Command and Control Element
C2N	Command and Control Network

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

C3	Command, Control, and Communication
C3I (or C3I)	Command, Control, Communication, and Intelligence
C4	Command, Control, Communication, and Computers
C5s	Computer Program Product Specifications
CA	Combined Arms <i>or</i> Contract Award
CAA	Clean Air Act
CAC	Combined Arms Command
CACCD	Combined Arms Command Combat Developments
CACDA	Combined Army Combat Development Agency
CAE	Computer-Aided Engineering
CAI	Combined Arms Initiatives
CAIG	Cost Analysis Improvement Group
CALS	Computer-Aided Acquisition and Logistics Support
CALSA	Computer-Aided Logistics Support Analysis
CALSIP	Computer-Aided Acquisition and Logistics Support Implementation Plan
CARC	Chemical Agent Resistant Coating
CARD	Cost Analysis Requirements Document
CAS	Chemical Abstract Service
CASA	Cost Analysis Strategy Assessment
CASCOM	Combined Arms Support Command
CATES	Counter Air Test and Evaluation Test Suite
C/ATLAS	Common/Abbreviated Test Language for all Systems
CATTD	Component Advanced Technology Test Bed
CB	Chemical/Biological

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

CBR	Chemical, Biological, Radiological
CBD	Commerce Business Daily
CBTDEV	Combat Developer
C&C	Collection and Classification
CCB	Configuration Control Board
CCC	Component Command Center
CCE	Communications and Electronics
CCH	Close Combat Heavy
CCS	Command and Control Systems
CD	Combat Developer
CDC	Centers for Disease Control and Prevention
CDE	Chemical Defense Equipment
CDEC	Combat Development Experimentation Center
CDR	Critical Design Review
CDRL	Contract Data Requirements List
CDW	Critical Design Walkthroughs
CE	Continuous Evaluation <i>or</i> Collateral Enclave
CECOM	Communications and Electronics Command
CE&D	Concept Exploration and Development
CEE	Commercial Equivalent Equipment
CEGL	Continuous Exposure Guidance Level
CEP	Concept Evaluation Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability
CERL	U.S. Army Construction Engineering Research Laboratory

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

CERT	Combined Environment Reliability Test
CEV	Combat Engineer Vehicle
CFC	Chlorofluorocarbons
CFE	Contractor Furnished Equipment
CFP	Concept Formulation Package
CG	Commanding General
CG, AMC	Commander, U.S. Army Materiel Command
CGC	Combat Gap Crosser
CGV	Command Group Vehicle
CHAMMP	Comprehensive Materials Management Program
CHPPM	Center for Health Promotion and Preventive Medicine (Provisional)
CHS	Common Hardware and Software
CI	Configuration Items
CIE	Clothing and Individual Equipment
CISPO	Combat Identification Systems Project Office
CIU	Communications Interface Unit
CIVR	Configuration Item Verification Review
CLS	Contractor Logistics Support
CM	Countermeasures <i>or</i> Configuration Management
CMD	Command
CMDT	Commandant
CMP	Configuration Management Plan
CMS	Configuration Management System
CMV	Combat Mobility Vehicle
CNM	Communications Network Management

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

CNR	Combat Net Ratio
COA	Course of Action
COE	Corps of Engineers
COEA	Cost and Operational Effectiveness Analysis
COFT	Conduct of Fire Trainer
COI	Critical Operational Issue
COIC	Critical Operational Issues and Criteria
COM3	Communications Common Components
COMARSPACE	Commander, Army Space Command
COMM	Communications
COMSEC	Communication Security
CONOPS	Continuity of Operations
CONUS	Continental United States
COR	Contracting Officer's Representative
COSCOM	Corps Support Command
COSIS	Care of Supplies in Storage
COTR	Contracting Officer Technical Representative
COTS	Commercial Off-the-Shelf
CP	Command Post
CPAF	Cost Plus Award Fee
CPC	Computer Program Component
CPCI	Computer Program Component Item
CPO	Civilian Personnel Office
CPU	Central Processing Unit
CPX	Command Post Exercise

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

CRDP	Computer Resources Development Plan
CRDS	Crew Requirement Definition Subsystem and Methodology
CRLCMP	Computer Resources Life Cycle Management Plan
CRMP	Computer Resource Management Plan or Communication Resource Management Plan
CRWG	Computer Resources Working Group
CS	Common Software
CSC	Computer Software Component <i>or</i> Combat Support Company
CSCI	Computer Software Configuration Item
CSS	Combat Services Support
CSSCS	Combat Service Support Control System
CSSV	Combat Support Smoke Vehicle
CSTA	Combat Systems Test Activity
CSU	Computer Software Units
CTD	Commercial Training Device
CTDR	Commercial Training Device Requirement
CTEA	Cost and Training Effectiveness Analysis
CTR	Center
CTS	Contact Test Set
CUCV	Commercial Utility Cargo Vehicle
CWA	Clean Water Act
CWBS	Contractor Work Breakdown Structure
CW/CBD	Chemical Warfare/Chemical and Biological Defense
CY	Calendar Year
CZMA	Coastal Zone Management Act

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

DA	Department of the Army
DAB	Defense Acquisition Board
DAC	Department of the Army Civilian <i>or</i> Days After Contract Award
DAE	Department of Defense Acquisition Executive
DAES	Defense Acquisition Executive Summary
DAG	Data Authentication Group
DAP	Designated Acquisition Program
DA PAM	Department of Army Pamphlet
DAR	Defense Acquisition Regulation
DATM	Department of the Army Technical Manuals
dBA	decibels A weighted
dBC	decibels C weighted
dBP	decibels peak
DCA	Defense Communications Agency <i>or</i> Diagnostic Connector Assemblies
DCD	DESCOM Candidate Depot
DCN	Design Change Notice
DCP	Decision Coordinating Paper <i>or</i> Design Concept Paper
DCSCD	Deputy Chief of Staff for Combat Development
DCSINT	Deputy Chief of Staff for Intelligence
DCSLOG	Deputy Chief of Staff for Logistics
DCSOPS	Deputy Chief of Staff for Operations and Plans
DCSPER	Deputy Chief of Staff for Personnel
DCSPLANS	Deputy Chief of Staff for Plans, Force Integration, and Analysis
DED	Data Element Definition

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

DEFCON	Defense Readiness Condition
DEM/VAL	Demonstration/Validation
DEP	Draft Equipment Publication
DEWV	Directed Energy Warfare Vehicle
DFCS	Drone Formation Control System
DIA	Defense Intelligence Agency
DID	Data Item Description
DISA	Defense Information Systems Agency
DISC4	Directorate of Information Systems for Command, Control, Communications, and Computers
DISCOM	Division Support Command
DJRU	Dedicated JTIDS Relay Unit
DLA	Defense Logistics Agency
DLAR	Defense Logistics Agency Regulation
DLM	Depot Level Maintenance
DLR	Depot Level Repairables
DLSC	Defense Logistics Supply Center
DLTS	Data Link Test Set
DMA	Defense Mapping Agency
DME	Dedicated Maintenance Evaluation
DMFP	Draft Materiel Fielding Plan
DMI	Depot Maintenance Interservice
DMPE	Depot Maintenance Plan Equipment
DMS	Depot Maintenance Study
DMSP	Depot Maintenance Support Plan

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

DMWR	Depot Maintenance Work Requirements
DOD	Department of Defense
DODD	Department of Defense Directive
DODI	Department of Defense Instruction
DODM	DOD Manual
DOD STD	DOD Standards
DOE	Department of Energy
DOL	Director of Logistics
DOT&E-SS	DOD Deputy Director, Operational Test and Evaluation, Strategic Systems
DP	Decision Points
DPAMMH	Direct Productive Annual Maintenance Manhours
DRMS	Defense Reutilization and Marketing Service
DS	Direct Support
DSARC	Defense Systems Acquisition Review Council
DSCS	Defense Satellite Communications System
DSMC	Defense Systems Management College
DSN	Defense Switch Network
DSPM	Detailed Subsystem Performance Model
DT	Developmental Test
DTC	Development and Training Center
DT&E	Developmental Test and Evaluation
DTIC	Defense Technical Information Center
DTM	Draft Technical Manual
DT/OT&E	Development Test and Operational Test and Evaluation

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

DTP	Detailed Test Plan
DUSA	Deputy Under Secretary of the Army
DWP	Deep Water Ports Act
E2I	Endoatmospheric/Exoatmospheric Interceptor
E3	AWACS Aircraft <i>or</i> Electromagnetic Environmental Effects
EA	Environmental Assessment
EAC	Echelons Above Corps
EARA	Equipment Authorization Review Activity
EATHS	Enhanced Airborne Target Handover System
EC	Environmental Control
ECA	Early Comparability Analysis
ECBRS	Enhanced Concept Based Requirements Analysis
ECCM	Electronic Counter Countermeasures
ECM	Electronic Countermeasures
ECP	Engineering Change Proposal
ECR	Embedded Computer Resources
EDM	Engineering Development Model
EDT	Engineer Design Testing
EEA	Environmental Education Act
EEGL	Emergency Exposure Guidance Level
EHAT	Equipment Historical Availability Trends
EHF	Extra High Frequency
EHTU	Enhanced Hand-held Terminal Unit
EIR	Equipment Improvement Reports

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

EIS	Environmental Impact Statement
EITF	ERIS Integrated Test Facility
EJSE	Enhanced JTIDS System Exerciser
EKMS	Electronic Key Management System
EL	Electronics Aptitude Area
ELF	Extremely Low Frequency
EMC	Electromagnetic Compatibility
EMCON	Emission Control
EMD	Engineering and Manufacturing Development
EMF	Enlisted Master File
EMI	Electromagnetic Interference
EMP	Electromagnetic Pulse
EMRO	Electromagnetic Radiation Operation
EMT	Environmental Management Team
ENDO	Endo-Atmospheric
ENG	Engineering
EOA	Early Operational Assessment
EOC	Element Operational Center
EOCM	Electro-Optic Countermeasures
EOCTS	Electro-Optic Contact Test Set
EOD	Explosive Ordnance Disposal
EODT	Explosive Ordnance Trainer
EPA	Environmental Protection Agency
EPAA	Environmental Programs Assistance Act
EPCRTK	Emergency Planning and Community Right to Know Act

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

EPLRS	Enhanced Position Location Reporting System
EPUU	Enhanced PLRS User Unit
ERDEC	Edgewood Research, Development, and Engineering Center
ERIS	Exoatmospheric Interceptor System
ESA	Endangered Species Act
ESC	Electronic Security Command
ESDU	Enhanced Stand-alone Display Unit
ESE	Element Support Equipment
ESECA	Energy Supply and Environmental Coordination Act
ESM	Electronic Surveillance Measures
ESS	Environmental Stress Screening
ET	Embedded Training
ETDL	Electronics Technology and Devices Laboratory
ETM	Electronic Technical Manuals
EUIT	Early User Innovative Test
EUT&E	Early User Test and Evaluation
EW	Electronic Warfare
EWR	Early Warning Radar
EXCON	Executive Control
FAAD	Forward Area Air Defense
FAADS	FAAD System
FAAR	Forward Area Alerting Radar
FAASV	Field Artillery Ammunition Support Vehicle
FARV-A	Future Armored Resupply Vehicle-Ammunition

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

FAT	First Article Test
FCA	Functional Configuration Audit
FCE&T	Field Concept Evolution and Trials
FD	Functional Description
FDDI	Fiber Distributed Data Interface
FDL	FAAD Data Link
FDP	Foreign Disclosure Plan
FDT&E	Force Development Test and Experimentation
FEA	Front-end Analysis
FEBA	Forward Edge of the Battle Area
FEDS	Facility Entry Denial System
FHL	Ft. Hunter-Liggett
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FIFV	Future Infantry Fighting Vehicle
FITSS	FAADS Integration Test Support System
FIDL	FAADS Instrumentation Data Link
FLC	Force Level Control
FLIR	Forward Looking Infrared
FLOT	Forward Line of Own Troops
FLPMA	Federal Land Policy Management Act
FMECA	Failure Modes Effects and Criticality Analysis
FOC	Full Operational Capability
FOG-M	Fiber Optical Guided-Missile
FON	Fiber Optics Network
FORSCOM	U.S. Army Forces Command

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

FOT&E	Follow-on Operational Test and Evaluation
FP	Force Package <i>or</i> Functional Proponent
FPA	Focal Plane Array
FPC	Formal Provisioning Conference
FPD	Functional Purchase Description
FQT	Formal Qualification Test
FRACAS	Failure Reporting, Analysis, and Corrective Action System
FRCA	Formal Contract Award
FRP	Full Rate Production
FRV	Future Reconnaissance Vehicle
FS	Fire Support
FSA	Full Site Activation
FSCOLS	Fire Support Combat Observation Lasing System
FSD	Full-Scale Development
FSE	Fire Support Element
FSED	Full-Scale Engineering Development
FSM	Forward Support Maintenance
FSP	Full-Scale Production
FTV	Functional Technology and Validation
FTX	Field Training Exercise
FU	Fire Unit
FUD	Fire Unit Display <i>or</i> First Unit Deployed
FUE	First Unit Equipped
FUED	First Unit Equipped Date
FW	Fixed Wing

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

FWF Fixed Word Format

FY Fiscal Year

FYP Five Year Plan

G-3 Division Operations

GAO General Accounting Office

GBI Ground Based Interceptor

GBI-X Ground Based Interceptor-Experimental

GBR Ground Based Radar

GBR-T Ground Based Radar-Terminal

GBR-X Ground Based Radar-Experimental

GBS Ground Based Sensor *or* Ground Based Segment

GEP Ground Entry Point

GFE Government Furnished Equipment

GFI Government Furnished Information

GFM Government Furnished Material

GM General Manager

GMD Global Missile Defense

GMDS Global Missile Defense System

GMF Ground-Mobile Forces

GPALS Global Protection Against Limited Strikes

GPALS/BMC3 GPALS System with Battle Management/C³

GPS Global Positioning System

GS General Support

GSA General Services Administration

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

GSE	Ground Support Equipment
GSTS	Ground Based Surveillance and Tracking System
(H)	Heavy
HAMS	Hardness Assurance Maintenance Surveillance
HARDMAN	Hardware vs. Manpower
HARDMAN III	Hardware versus manpower comparability methodology. Pc-based model for simulation of total system performance.
HAZMIN	Hazardous Waste Minimization
HCI	Hardness Critical Items
HCM	HARDMAN Comparability Methodology
HCP	Hardness Critical Processes
HDL	Harry Diamond Laboratories
HDU	Hard Disk Unit
HE	Human Engineering
HEDI	High Endoatmospheric Defense Interceptor
HEDR	Human Engineering Domain Report
HEL	Human Engineering Laboratory
HEO	High Earth Orbit
HEPA	High-Efficiency Particulate Air
HFE	Human Factors Engineering
HFEA	Human Factors Engineering Assessment
HFES	Human Factors Engineering Strategy
HFM	Heavy Force Modernization
HH	Health Hazard

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

HA	Health Hazard Assessment
HHAR	Health Hazard Assessment Report
HHB	Headquarters and Headquarters Battery
HHDR	Health Hazard Domain Report
HIMAD	High-to-Medium Altitude Air Defense
HLU	High Level Unit
HMMP	Hazardous Material Management Program
HMMWV	High Mobility Multipurpose Wheeled Vehicle
HNS	Host Nation Support
HOE	Homing Overlay Experiment
HQ	Headquarters
HQDA	Headquarters, Department of the Army
HQUSACE	Head U.S. Army Corps of Engineers
HSB	Heavy Separate Brigade
HSC	U.S. Army Health Services Command
HSI	Human Services Integration <i>or</i> Human Systems Integration
HSIP	Human Services Integration Plan
HSWA	Hazardous Solid Waste Amendment
HTK	Hit-to-Kill
HTU	Hand-held Terminal Unit
HW	Hardware
HWCI	Hardware Configuration Item
HWIL	Hardware-in-the-Loop
IA	Independent Assessor

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

IACOP	International Armament Cooperative Opportunities Plan
IARC	International Agency for Research on Cancer
IA&T	Integration, Assembly, and Test
IAW	In Accordance With
I&C	Issues and Criteria
ICBM	Intercontinental Ballistic Missiles
ICC	Information Control Center
ICD	U.S. Army Institute of Chemical Defense <i>or</i> Interface Control Drawing
ICDS	Interim Contractor Depot Support
ICE	Independent Cost Estimate
ICOM	Internal COMSEC
ICS	Interim Contractor Support
ICTP	Individual and Collective Training Plan (obsolete term—see STRAP)
ID	Identification <i>or</i> Infantry Division
IDS	Intrusion Detection Device
IDTS	Integrated Development Test Schedule
IE	Independent Evaluation <i>or</i> Independent Evaluator
IEP	Independent Evaluation Plan
IER	Independent Evaluation Report
IEW	Intelligence and Electronic Warfare
IEWV	Intelligence and Electronic Warfare Vehicle
IFB	Invitation for Bids
IFF	Identification Friend or Foe
IFLCS	Initial Force Level Control System

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

IFQT	Initial Formal Qualification Test
IFTE	Integrated Field Test Equipment <i>or</i> Integrated Family of Test Equipment
IFTU	In-Flight Target Update
IHD	Industrial Hygiene Division
IHHA	Initial Health Hazard Assessment
IHHAR	Initial Health Hazard Assessment Report
IJMS	Interim JTIDS Message Standard
I&KP	Instruction and Key Personnel
ILS	Integrated Logistics Support
ILSEB	ILS Executive Board
ILSM	Integrated Logistics Support Manager
ILSMM	Integrated Logistics Support Management Model
ILSMT	Integrated Logistics Support Management Team
ILSP	Integrated Logistics Support Plan
ILSWG	Integrated Logistics Support Working Group
IMA	Independent Medical Assessor, Individual Mobilization Augmenter, Installation Medical Authority, <i>or</i> Information Mission Area
IMU	Inertial Measurement Unit
IOC	Initial Operational Capability
IOT&E	Initial Operational Test and Evaluation
IPA	Integrated Program Assessment
IPM	Inhalable Particulate Mass
IPR	In-Process Review
IPS	Integrated Program Summary
IPT	Initial Production Test

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

IRCM	Infrared Countermeasures
IRIG	Inter-Range Instrumentation Group
IS	Information Systems
ISA	Initial Site Activation
ISC	U.S. Army Information Systems Command
ISIL	Interim Support Items List
ISN	Intra-Site Network
ISP	Integrated Support Plan
ISSA	Interservice Support Agreements
ISWG	Integrated Support Working Group
IT	Innovative Test
I&T	Integration and Test
IVD	Interactive Video Device
IV&V	Independent Verification and Validation
IWSD	Integrated Weapons System Display
J&A	Justification and Authorization
JASS	Job Assessment Software System
JCS	Joint Chiefs of Staff
JDMAG	Joint Depot Maintenance Analysis Group
JEWC	Joint Electronic Warfare Center
JIEO	Joint Interoperability Engineering Organization
JINTACCS	Joint Interoperability of Tactical Command and Control Systems
JMSNS	Justification for Major System New Start (obsolete term—see MNS)
JRMB	Joint Requirements Management Board

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

JSOR Joint Services Operational Requirement (obsolete term—see ORD)

JTA Joint Table of Allowances

JTIDS Joint Tactical Information Distribution System

JWG Joint Working Group

KHILS KKV Hardware-in-the-Loop System

KHIT KKV Hover Integrated Test

KKV Kinetic Kill Vehicle

KMS Key Management Station

KV Kill Vehicle

KVFL Kill Vehicle Flight

kW Kilowatts

(L) Light

LABCOM Laboratory Command

LAIR Letterman Army Institute of Research

LAN Local Area Network

LCBPG Lightweight Chemical-Biological Protective Garment

LCC Life Cycle Cost

LCCM Life Cycle Cost Model

LCCS Life Cycle Contractor Support

LCM Life Cycle Management

LCN Logistics Support Analysis Control Number

LCSEC Life Cycle Software Engineering Center

LCSMM Life Cycle System Management Model

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

LD	Logistics Demonstration
LDR	Low Data Rate
LEA	Logistics Evaluation Agency
LEAP	Lightweight Exoatmospheric Advanced Projectile
LEL	Lowest-Effect Level
LETS	LWIR Environment and Threat Simulator
LF	Launch Farm
LFT&E	Live Fire Test and Evaluation
LIA	Logistics Impact Analysis
LL	Limited Life
LLI	Long Lead Item
LLT	Long Lead Time
LLTI	Long Lead Time Items
LLTR	Low Level Transit Route
LMD	Logistics Maintainability Demo
LMSC	Lockheed Missiles & Space Company
LNC	Local Network Controller
LNO	Liaison Officer
LOAEL	Lowest-Observed-Adverse Effect Level
LOC	Limited Operational Capability
LOGAM	Logistics Analysis Model
LORA	Level of Repair Analysis
LORAP	Level of Repair Analysis Plan
LOS	Line-of-Sight <i>or</i> Logistics Oriented School

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

LOSAD	Line-of-Sight Air Defense
LOSAT	Line-of-Sight Antitank
LOS-F-H	Line-of-Sight-Forward-Heavy
LOS-R	Line-of-Sight-Rear
LOT	Limited Operational Test
LPI	List of Parts Illustration
LRAD	Logistics and Readiness Analysis Division
LRIP	Low Rate Initial Production
LRP	Low-Rate Production
LRRDAP	Long Range Research, Development, and Acquisition Plan
LRU	Line-Replaceable Unit
LSA	Logistic Support Analysis
LSAP	Logistic Support Analysis Plan
LSAR	Logistic Support Analysis Record
LSART	Logistic Support Analysis Review Team
LSDIS	Light and Special Division Interim Sensor
LSN	Local Stock Number
LUT	Limited User Test
LWIR	Long-Wave Infrared
MA	Managing Activity
MAA	Mission Area Analysis
MAC	Maintenance Allocation Chart
MACOM	Major Command
MADP	Materiel Acquisition Decision Process

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

MAIS	Major Automated Information Systems
MAISRC	Major Automated Information System Review Council
MAMP	Mission Area Management Plan
MANCAP	MANPRINT Mission Capability Analysis
MANPADS	Manportable Air Defense System
MANPRINT	Manpower and Personnel Integration
MAN-SEVAL	Manpower-based System Evaluation Aid
MANTECH	Manufacturing Technology
MAP	Materiel Acquisition Plan/Process
MARB	Materiel Acquisition Review Board
MARC	Manpower Requirements Criteria
MARS	Maintenance and Repair System Vehicle
MATDEV	Materiel Developer
MATTR	Midcourse and Terminal Tier Review
MB	Megabyte
MBP	Manpower Billpayer Plan
MC	Maneuver Contact <i>or</i> Materiel Change
MCA	Military Construction, Army <i>or</i> Military Construction Appropriation
MCCR	Mission Critical Computer Resources
MCM	Materiel Change Management
M-CON	Manpower Constraint Aid
MCP	Materiel Change Package
MCRC	Master Control and Reporting Center
MCS	Maneuver Control System

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

MD	Maintainability Demonstration
MDA	Milestone Decision Authority <i>or</i> Missile Defense Act
MDAP	Major Defense Acquisition Program
MDR	Milestone Decision Review
MED	Medical
MEDCEN	Medical Centers
MEDCOM	U.S. Army Medical Command
MEDDAC	Medical Department Activities
MEIDS	Militarized Electronic Information Delivery System
MEP	Mobile Electrical Power
MER	Manpower Estimate Report
METT-T	Mission, Enemy, Terrain and Weather, Troops, and Time-Available
MF	Mission Failure
MFA	Material Fielding Agreement
MFASE	Message Formatting Application Service Element
MFP	Materiel Fielding Plan
MGEP	Mobile Ground Entry Point
MHE	Materiel Handling Equipment
MI	Military Intelligence <i>or</i> Market Investigation
MICOM	Missile Command
MILCON	Military Construction
MIL HDBK	Military Handbook
MIL SPEC	Military Specification
MIL STD	Military Standard
MIS	Management Information System

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

MIST	Man Integrated System Technology
MITLA	Microcircuit Technology in Logistics Applications
MJWG	MANPRINT Joint Working Group
MLRPS	Manpower Long Range Planning System
MLRS	Multiple Launch Rocket System
MM	Man-Machine <i>or</i> Mechanical Maintenance Aptitude Area
MMC	Materiel Management Center
MMI	Man-Machine Interface
MMMP	Manufacturers MANPRINT Management Plan
MMP	Maintenance Management Plan
MMPA	Marine Mammal Protection Act
MNS	Mission Need Statement
MOA	Memorandum of Agreement
MOC	Mobile Operations Center
MOPP	Mission Oriented Protection Posture
MOS	Military Occupational Specialty
MOTR	Multiple Object Tracking Radar
MOU	Memorandum Of Understanding
M&P	Manpower and Personnel
MP	Mission Profile
MPT	Manpower, Personnel, and Training
MPTA	Manpower, Personnel, and Training Assessment
MPTS	Manpower, Personnel, Training, and Safety
MR	Maintenance Ratio
MRA	Manpower and Reserve Affairs

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

MRD	Mission Requirements Document
MRMC	U.S. Army Medical Research Materiel Command
MREI	Manufacturing Reserve of Essential Items
MRRB	Material Readiness Review Board
MRSA	Materiel Readiness Support Activity
MRSPA	Marine Protection, Research, and Sanctuaries Act
MS	Multi-Service, Materiel System, <i>or</i> Milestone
MSC	Major Subordinate Command
MSDS	Material Safety Data Sheet
MSE	Mobile Subscriber Equipment
MSEU	Mass Storage Expansion Unit
MSL	Missile
MSP	Mission Support Plan
MSRS	Material System Requirements Specification
MST	Maintenance Support Team
MTBF	Mean Time Between Failure
MTBHMF	Mean Time Between Hardware Mission Failure
MTBMA	Mean Time Between Maintenance Actions
MTBOMF	Mean Time Between Operational Mission Failure
MTD	Materiel Test Directorate
MTF	Message Text Format
MTL	U.S. Army Material Technology Laboratory
MTMC	Military Traffic Management Command
MTMCTEA	Military Traffic Management Command and Transportation Engineering Agency

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

MTOE	Modified Table of Organization and Equipment
MTP	Materiel Fielding Plan
MTTR	Mean Time to Repair
MTS	Masked Target Sensor
MTTR	Mean Time To Repair
MTTS	Multiple Target Tracking System
MWOS	Modification Work Orders
MWS	Mortar Weapon System
MZAD	Meinz Army Depot
N/A	Not Applicable
NAEW	NATO Early Airborne Warning
NAS	National Aerospace Standard
NATO	North Atlantic Treaty Organization
NAVSCOLEOD	Naval School of EOD
NBC	Nuclear, Biological, and Chemical
NBCCS	NBC Contamination Survivability
NBCRS	Nuclear, Biological, and Chemical Reconnaissance System
NCA	Nuclear and Chemical Agency, National Command Authority, <i>or</i> Noise Control Act
NCS	Net Control Station
NCSC	Nuclear and Chemical Survivability Committee
NCSCS	NCSC Secretariat
NCTR	Noncooperative Target Recognition
NDCEE	National Defense Center for Environmental Excellence

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

NDI	Nondevelopment Item
NEOF	No Evidence of Failure
NEPA	National Environmental Policy Act
NET	New Equipment Training
NETP	New Equipment Training Plan
NETT	New Equipment Training Team
NFPA	National Fire Protection Association
NG	National Guard
NICP	National Inventory of Control Point
NIST	National Institute of Standards and Technology
NLOS	Non-Line-Of-Sight
NLOSAD/AT	Non-Line-Of-Sight Air Defense/Antitank
NMD	National Missile Defense
NMIBT	New Materiel Introductory Briefing Team
NMP	National Maintenance Point
NOAEL	No Observed Adverse Effects Level
NOE	Nap-Of-the-Earth
NOEL	No Observed Effects Level
NOFORN	No Foreign
NON-DIV FMC	Nondivisional Forward Maintenance Companies
NOV	Notice of Violation
NRDEC	U.S. Army Natick Research, Development, and Engineering Center
NS	Nuclear Survivability
NSA	National Security Agency
NSN	National Stock Number

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

NTB	National Test Bed
NTDS	Navy Tactical Data System
NTF	National Test Facility
NWPA	Nuclear Waste Policy Act
OBCE	Operational Baseline Cost Estimate
OCE	Office, Corps of Engineers
OCONUS	Other Than Continental United States
ODCSPER	Office of the Deputy Chief of Staff for Personnel
OEC	Operational Evaluation Command
OEM	Original Equipment Manufacturer
OF	Operator/Food
OFT	Operational Feasibility Testing
OGT	Off-Green Time
OI	Operational Issues
OIE	Operational Independent Operator
OJT	On the Job Training
OMF	Operational Mission Failure
OMS	Operational Mode Summary
OMT	Organizational Maintenance Trainer
OMS/MP	Operational Mode Summary/Mission Profile
O&O Plan	Operational and Organizational Plan
OPA	Other Procurement, Army <i>or</i> Oil Pollution Act
OPCON	Operational Control
OPFAC	Operational Facilities

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

OPFOR	Opposing Forces
OPM	Office of Personnel Management
OPSEC	Operational Security
OPTADS	Operations Tactical Data Systems
OPTEC	Operational Test and Evaluation Command
OR	Operations Research
ORD	Operational Requirements Document
ORF	Operational Readiness Float
ORLA	Optimum Repair Level Analysis
OS	On-Site
O&S	Operations and Support <i>or</i> Operation and Sustainment
OSAMM	Optimum Supply and Maintenance Model
OSD	Office of the Secretary of Defense
OSE	Organization Support Equipment
OSHA	Occupational Safety and Health Administration
OSM	Operation Support Maintenance
OSUT	On-Site User Test
OT	Operational Test <i>or</i> Operating Time
OT&E	Operational Test and Evaluation
OTEA	Operational Test and Evaluation Agency (obsolete)
OTP	Outline Test Plan
OTRS	Operational Test Readiness Statement
OTSG	Office of the Surgeon General
P3I	Pre-Planned Product Improvement

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

PAD	Product Assurance Directorate
PAM	Pamphlet
PAT	Process Action Team
PAWG	Program Assessment Work Group
PBMA	U.S. Army Production Based Modernization Activity
PBV	Post-Boost Vehicle
PBX	Multiplexers/Circuit Switches
PCA	Physical Configuration Audit
PCB	Printed Circuit Board
P-CON	Personnel Constraint Aid
PCP	Platoon Command Post
P&D	Production and Development
PDEP	Preliminary Draft Equipment Publication
PDR	Preliminary Design Review
PDSS	Post Deployment Software Support
PDW	Preliminary Design Walkthroughs
PE	Program Element
PEL	Permissible Exposure Limit
PENAIID	Penetration Aid
PEO	Program Executive Office
PER	Personnel
PERSCOM	Total Army Personnel Command
PER-SEVAL	Personnel-based System Evaluation Aid
PERSSO	Personnel Systems Staff Officer
PERT	Program Evaluation and Review Techniques

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

PFAT	Pre-First Article Test
PFA	Post Fielding Assessment
PFAP	Post Fielding Assessment Plan
PFCA	Post Fielding Comparability Analysis
PFTEA	Post Fielding Training Effectiveness Analysis
PGC	Provisioning Guidance Conference
PHA	Preliminary Hazard Analysis
PHID	Positive Hostile Identification
PHL	Preliminary Hazards List
PHS	Packaging, Handling, and Storage
PHS&T	Packaging, Handling, Storage, and Transportation
PIA	Manpower and Personnel Impact Analysis
PICES	Parametric Independent Cost Estimating System
PIL	Preferred Items List
PIP	Product Improvement Program
PLCCE	Program Life Cycle Cost Estimate
PLL	Prescribed Load List
PLRS	Position Location Reporting System
PLV	Payload Launch Vehicle
PM	Program Manager, Project Manager, Product Manager, <i>or</i> Preventive Medicine
PMA	Program Management Agreement
PMCS	Program Maintenance Control System
PMD	Program Management Documentation
PME	Prime Mission Equipment

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

PMO	Project Management Office
PMR	Program Management Reviews <i>or</i> Provisioning Master Record
PMS	Pedestal Mounted Stinger
PM TRADE	Project Manager of Training Devices
PO	Project Office
POC	Point of Contact
POI	Program of Instruction
PO&ILCCE	Program Office & Independent Life-Cycle Cost Estimates
POL	Petroleum, Oils, and Lubricants
POM	Program Objective Memorandum
POMCUS	Prepositioned Materiel Configured to Unit Sets
PP	Provisioning Plan
PPA	Pollution Prevention Act
PPBES	Planning, Programming, Budgeting, and Execution System
PPC	Provisional Performance Criteria
PPLI	Precise Position Location Information
ppm	parts per million
PPQT	Pre-Production Qualification Test
PPS	Post-Production Support
PPSP	Post-Production Support Plan
P/PSR	Program/Project Status Report
PPT	Production Proveout Test
PQT	Preliminary Qualification Test <i>or</i> Production Qualification Test
PRAM	Preliminary Reports of Aviation Mishaps
PREV MED	Preventive Medicine

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

PRIMIR	Product Improvement Information Reports
PRISS	Post Deployment Real-Time Interactive Simulator/Driver System
PRS	Provisioning Requirements Statement
PSE	Peculiar Support Equipment
PSR	Program/Project Status Report
PSS	Physical Security Subsystem or Particle Size-Selective
PTD	Provisioning Technical Documentation
PVT	Preproduction Verification Test
PWSA	Port and Waterway Safety Act
QASAS	Quality Assurance Specialist Ammunition Surveillance
QQPRI	Qualitative and Quantitative Personnel Requirements Information
QSTAG	Quadripartite Standardization Agreement
R2 (or R2)	Reporting Responsibility
RAC	Risk Assessment Code
R&D	Research and Development
RAM	Reliability, Availability, and Maintainability
RAMADCS	RAM Automated Data Collection System
RC	Reserve Component
RCF	Repair Cycle Float
RCM	Reliability Centered Maintenance
RCRA	Resource Conservation and Recovery Act
RDA	Research, Development, and Acquisition
RDDS	Range Data Distribution System

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

RDT&E	Research, Development, Test and Evaluation
REC	Radio Electronic Combat
ReMeDEe	Rapid Model Development Environment
RF	Radio Frequency
RFC	Reference Concentration
RFD	Reference Dose
RFI	Radio Frequency Interference
RFP	Request For Proposal
RFQ	Request for Quotation
RGQA	Radon Gas Indoor Air Quality Research Act
RICS	Range Instrumentation Control System
RIDB	Readiness Integrated Database
ROC	Required Operational Capability
ROC/COMM	Regional Operations Center/Communications
ROCS	Real-Time Operations Control System
ROK	Republic Of Korea
ROW	Rest of the World
RPM	Respirable Particulate Mass
RPSTL	Repair Parts and Special Tools List
RPV	Remotely Piloted Vehicle
RS	Readiness Station
RSA	Redstone Arsenal
RSSC	Regional Space Support Center
RTCA	Real-Time Casualty Assessment
RTD&E	Research, Testing, Development, and Evaluation

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

RTTC Redstone Technical Test Center

RV Re-entry Vehicle

RW Rotary-Wing

RWS Rigid Wall Shelter

RV Recovery Vehicle

S Soldier Survivability

S-2 Battalion Intelligence

S-3 Battalion Operations Section

S-5 Battalion Civil Affairs

SA Survivability Assessment

SAC Secretariat of Army Committee

SAE Service Acquisition Executive

SAIP Spares Acquisition Integrated Production

SAM Surface-to-Air Missile

SAR Safety Assessment Report

SARS Standard Army Refuel Systems

SAT Software Acceptance Test *or* Systems Approach to Training

SATCOM Satellite Communication

SAVA Standard Army VETRONICS

SBI Space-Based Interceptor

SBIR Small Business Innovation Research

SCCB Software Change Control Board

SCD Systems Confidence Demonstration

SCN Space Communications Network

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

SCP	System Concept Paper (obsolete term)
SCR	SATCOM Relay
SCUR	Selected Command Unit Review
SDC	Sample Data Collection
SDCP	Sample Data Collection Plan
SDD	System Description Document
SDI	Strategic Defense Initiative
SDIAE	Strategic Defense Initiative Acquisition Executive
SDIARC	Strategic Defense Initiative Advanced Research Center
SDIO	Strategic Defense Initiative Organization
SDP	Software Development Plan
SDPO	Site Development Program Office
SDR	System Design Review
SDS	Strategic Defense System
SDT	Software Development Tests
SDU	Stand-alone Display Unit
SDWA	Safe Drinking Water Act
SE	Support Equipment
SEA	Systems Engineering Analysis
SEAMS	Support Equipment Authorization Management
SEC	Software Engineering Center
SECDEF	Secretary of Defense
SED	Software Engineering Design
SEL	U.S. Army School of Engineering and Logistics
SEMP	System Engineering Management Plan

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

SEO	Survivability Enhancement Options
SEP	System Evaluation Plan
SESAME	Selected Essential Stockage Availability Method
SETA	System Engineering Technical Assistance
SETAC	Systems Engineering and Technical Assistance Contractor
SEWG	Software Engineering Working Group
SGS	Software Generation System
SHORAD	Short Range Air Defense
SHR	Super High Resolution
SHTU	Simplified Hand-held Terminal Unit
S&I	Standardization and Interoperability
SIC	System Integration Contractor
SICPS	Standard Integrated Command Post System
SIF	Selective Identification Feature
SIM	Simulation and Training
SINCGARS	Single Channel Ground and Airborne Radio System
SIP	State Implementation Plan
SIT	System Integrated Tests
SJA	Staff Judge Advocate
SKO	Sets, Kits, and Outfits
SLAC	Support List Allowance Card
SLAD	Survivability/Lethality Analysis Directorate
SLBM	Submarine Launched Ballistic Missile
SLV	Survivability/Lethality and Vulnerability
SMCRA	Surface Mine Control and Recovery Act

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

SME	Subject Matter Expert
SMI	Soldier-Machine Interface
SMMP	System MANPRINT Management Plan
SMR	Source, Maintenance, and Recoverability
SNC	System Network Control
SNF	Secret No Foreign
SOJ	Stand-Off Jammer
SOP	Standard Operating Procedures
SOPA	Stratospheric Ozone Protection Act
SORD	Soldier Oriented Research and Development
SORR	System Operational Readiness Review
SOW	Statement of Work <i>or</i> Scope of Work
SPA	Shore Protection Act
SPARC	System Performance and RAM Criterion
SPEGL	Short-Term Public Emergency Guidance Level
SPO	Security, Plans, and Operations
SPS	System Performance Simulation
SPTD	Supplemental Provisioning Technical Documentation
SRCU	SINCGARS Remote Control Unit
SRF	Support Resource Funds
SRO	System Readiness Objective
SRR	System Readiness Review
SRU	Shop Replaceable Unit
SS	System Safety
SSA	System Safety Assessment, Software Support Activity, <i>or</i> System Specification for ATCCS

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

SSDR	Subsystem Design Review
SSE	Source Selection Evaluation
SSEB	Source Selection Evaluation Board
SSEP	Source Selection Evaluation Plan
SSET	Source Selection Evaluation Test
SSG	Special Study Group
SSGA	Special Study Group Armor
SSI	Special Skill Identifier
SSJ	Single Sideband Jammers
SSP	System Support Package
SSPCL	System Support Package Component Lists
SSPP	System Safety Program Plan
SSR	Sub-System Review <i>or</i> Software Specification Review
SSRA	System Safety Risk Analysis
SSS	Storage Serviceability Standard
SSTS	Space-Based Surveillance and Tracking System
SSWG	System Safety Working Group
ST	Soft Top
STANAG	Standardization Agreement
STAR	System Threat Assessment Report
ST&E	System Test and Evaluation
STEP	Software T&E Panel
STF	Special Task Force
STR	Software Test Review
STRAP	System Training Plan

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

STS	Soft Top Shelter
SV	Sapper Vehicle
SW	Software
SWCI	Software Configuration Item
SWIT	Software Integration and Test
SWRCA	Soil and Water Resources Conservation Act
TAAF	Test, Analyze, and Fix
TAC	Tactical Air Control
TAD	Target Audience Description
TADIL	Tactical Data Information Link
TADSS	Training Aids, Devices, Simulators, and Simulations
TALDT	Total Administrative and Logistics Down Time
TAMMS	The Army Maintenance Management System
TAOM	Tactical Air Operations Module
TAPC	Total Army Personnel Command
TBD	To Be Determined
TBP	To Be Published
TCIM	Tactical Computer Interface Module
TC	Type Classified
TCD	Time/Code Distribution
TCM	Total Corrective Maintenance
TCN	Terrestrial Communications Network
T-CON	Training Constraint Aid
TCU	Transportable Computer Unit

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

TD	Training Device <i>or</i> Technical Directive
TDA	Table of Distribution and Allowances
TDAR	Tactical Defense Alert Radar
TDCFP	Training Devices Concept Formulation Package
TDMA	Time Division Multiple Access
TDNS	Training Device Need Statement
TDP	Test Design Plan <i>or</i> Technical Data Package
TDR	Training Device Requirement
TDS	Training Decisions System
T&E	Test and Evaluation
TEA	Training Effectiveness Analysis <i>or</i> Transportability Engineering Analysis
TEC	TEXCOM Test and Experimentation Command
TECOM	Test and Evaluation Command
TEISS	The Enhanced Integrated Soldier System
TEM	Test and Evaluation Methodology
TEMA	Test and Evaluation Management Agency
TEMOD	Test Equipment Modernization
TEMP	Test and Evaluation Master Plan
TEP	Test and Evaluation Plan
TEXCOM	Test and Experimentation Command
TFT	Technical Feasibility Testing
THAAD	Theater High Altitude Air Defense
TI	Technical Insertion
TIA	Training Impact Analysis

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

TIDP	Technical Interface Design Plan
TIE	Technical Independent Evaluator
TILO	Task Information Liaison Officer (AMC)
TIP	Test Integration Plan
TIR	Test Incident Report <i>or</i> Terminal Imaging Radar
TIREM	Terrain Integration Rough Earth Model
TIWG	Test Integration Working Group
TLCPC	Top Level Computer Program Component
TLV	Threshold Limit Value
TLV-C	Threshold Limit Value - Ceiling
TLV-STEL	Threshold Limit Value - Short-Term Exposure Limit
TM	Technical Manual
TMD	Theater Missile Defense
TMDE	Test Measurement and Diagnostic Equipment
TMD-GBR	Theater Missile Defense-Ground Based Radar
TMP	Transportation Motor Pool
TNG	Training
TNGDEV	Training Developer
TOA	Trade-Off Analysis
TOC	Tactical Operations Center
TOD	Trade-Off Determination
TOE	Table of Organization and Equipment
TOM	Threat Object Map
TPF	Total Package Fielding
TPIO	TRADOC Program Integration Office

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

TPM	Total Preventive Maintenance or Thoracic Particulate Mass
TPS	Test Program Set
TPT	Tactical Proficiency Trainer
TP/UMF	Total Package/Unit Materiel Fielding
TR	Test Report
T/R	Transmit/Receive
TRADOC	U.S. Army Training and Doctrine Command
TRANSEC	Transmission Security
TRASSO	Training and Doctrine Command System Staff Officer
TRD	Technical Requirements Document
TRGDEV	Training Developer
TROSCOM	Troop Support Command
TRR	Test Readiness Reviews
TSARC	Test Schedule and Review Committee
TSCA	Toxic Substances Control Act
TSE	TOC Support Element
TSG	The Surgeon General
TSM	TRADOC System Manager
TSOP	Tactical Standing Operating Procedures
TSP	Training Support Package
TT	Technical Test (obsolete)
T&T	Transportation and Transportability
T&TD	Training and Training Device
TT&E	Technical Test & Evaluation
TTE	Terrestrial Terminal Equipment

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

TTP	Tactics, Techniques, and Procedures
TTS	Temporary Threshold Shift
TTSP	Threat Test Support Package
TVC	Thrust Vector Control
TVE	Technology Validation Equipment
TVM	Test Verification Matrix
TWA	Time-Weighted Average
TWT	Traveling Wave Tube
UAV	Unmanned Aerial Vehicle
UCMJ	Uniform Code of Military Justice
UESSR	Unit Equipment Status and Serviceability Report
UF	Uncertainty Factor
UIR	User Interface Requirement
UMR	Unsatisfactory Materiel Reports
UOE	User Operational Evaluation
UOES	User Operational Evaluation System
US	United States
USA	United States of America
USAADASCH	U.S. Army Air Defense Artillery School
USAARL	U.S. Army Aeromedical Research Laboratory
USACBDA	U.S. Army Chemical and Biological Defense Agency
USACOE	U.S. Army Corps of Engineers
USACTA	U.S. Army Central TMDA Activity
USADESCOM	U.S. Army Depot Support Command

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

USAF	U.S. Air Force
USAIC	U.S. Army Information Systems Command
USAKA	U.S. Army Kwajalein Atoll
USAMC	U.S. Army Materiel Command
USAMICOM	U.S. Army Missile Command
USAMMDA	U.S. Army Medical Materiel Development Activity
USANCA	U.S. Army Nuclear and Chemical Agency
USAOMMCS	U.S. Army Ordnance Missile and Munitions Center and School
USAOPTEC	U.S. Army Operation Test and Evaluation Command
USAR	U.S. Army Reserve
USAREUR	U.S. Army Europe
USARIEM	U.S. Army Research Institute of Environmental Medicine
USARSPACE	U.S. Army Space Command
USASA	U.S. Army Security Agency
USASC	U.S. Army Safety Center
USASSDC	U.S. Army Space and Strategic Defense Command
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
USATRADO	U.S. Army Training and Doctrine Command
USATSG	U.S. Army TMDE Support Group
USCINCSpace	Commander in Chief, U.S. Space Command
USDA	U.S. Department of the Army
USEPA	U.S. Environmental Protection Agency
USMC	U.S. Marine Corps
USMTF	U.S. Message Text Formats

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

USN U.S. Navy

USSPACECOM U.S. Army Space Command

USSR Union of Soviet Socialist Republic

UT User Testing (obsolete)

UTTMD Upper Tier Theater Missile Defense

UTTMDS Upper Tier Theater Missile Defense System

UV Ultraviolet

V Version

VAL Vulnerability Assessment Laboratory

VCOS Vehicle Control Operating System

VETRONICS Vehicle Electronics

VOC Volatile Organic Compound

V&V Verification and Validation

WBGT Wet Bulb Globe Temperature

WBS Work Breakdown Structure

WCO Weapon Control Order

WCS Weapons Control Status

WFLA Warfighting Lens Analysis

WHINTEL With Human Intelligence

WPCA Water Pollution Control Act

WPN Weapon

WRAIR Walter Reed Army Institute of Research

WRPA Water Resources Planning Act

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

WSMR White Sands Missile Range

XTB Experimental Test Bed

ZLIN Development TOE Line Item Number

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

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APPENDIX S

Glossary of Terms

■ This appendix contains a listing of definitions for both health hazard and acquisition-related terms. While it is not all inclusive, it will provide you assistance in better understanding what you are reading or hearing.

The penetration of a substance into or through another. The physical uptake and entry of a substance into the body through intact skin, inhalation into the lungs, or ingestion.

Absorption

An estimate of the dose resulting from exposure to a toxicant that is likely to be without deleterious effect even if continued exposure occurs over a lifetime.

Acceptable Daily Intake

The discrepancy between the true value and the result obtained by measurement.

Accuracy

Acoustical energy (steady-state, impulse noise, and blast overpressure) is the potential energy that exists in a pressure wave that is transmitted through air, which may interact with the body to cause hearing loss or damage to internal organs.

Acoustical Energy

Category I Selection Criteria:

- A program not classified as highly sensitive by the Secretary of Defense that has:
 - Been designated by the Under Secretary of Defense (Acquisition) as an acquisition category I program or is

Acquisition Categories

GLOSSARY OF TERMS

- Estimated by the Under Secretary to require
 - An eventual expenditure for research, development, test, and evaluation of more than \$200 million in fiscal year 1980 constant dollars (approximately \$300 million in fiscal year 1990 constant dollars); or

Category II Selection Criteria:

- A program not meeting the criteria for category I that has:
 - Been designated by the DOD component head as an acquisition category II program or is
 - Estimated by the DOD Component Head to require:
 - An eventual expenditure for research, development, test, and evaluation of more than \$75 million in fiscal year 1980 constant dollars (approximately \$115 million in fiscal year 1990 constant dollars); or
 - An eventual expenditure for procurement of more than \$300 million in fiscal year 1980 constant dollars (approximately \$540 million in fiscal year 1990 constant dollars)

Category III Selection Criteria:

- A program not meeting the criteria for categories I and II that have been designated category III by the DOD Component Acquisition Executive.

Category IV Selection Criteria:

- All other acquisition programs for which the milestone decision authority should be delegated to a level below that required for category III.

Acquisition Plan (AP)

The Acquisition Plan is derived from the Acquisition Strategy and summarizes acquisition background and need, objectives, conditions, strategy, and related functional planning (with emphasis on contractual aspects). It provides detailed planning for contracts and milestone charting.

GLOSSARY OF TERMS

Acquisition program baselines embody the cost, schedule, and performance objectives for the program. The APB will initially be developed as a Concept Baseline for the Milestone I decision point. The APB is developed as a Development Baseline for Milestone II, and as a Production Baseline for Milestone III. The baseline parameters represent the objectives and thresholds for the system to be produced and fielded. Each baseline contains objectives for key cost, schedule, and performance parameters. The purpose of the APB is to enhance program stability, and provide a critical reference point for measuring and reporting the status of program implementation.

**Acquisition Program
Baselines (APB)**

The conceptual framework for conducting materiel acquisition, encompassing the broad concepts and objectives that direct and control the overall development, production, and deployment of a materiel system. It evolves in parallel with the system's maturation. Acquisition strategy must be stable enough to provide continuity, but dynamic enough to accommodate change.

Acquisition Strategy (AS)

Effects that arise quickly and have a short and relatively severe course.

Acute Effects

One dose or multiple dose exposure occurring within a short time (< 24 hours).

Acute Exposure

Another term used to describe immediate toxicity. Its use is associated with toxic effects that are severe (e.g., mortality) in contrast to the term "subacute toxicity," which is associated with toxic effects that are less severe. The term "acute toxicity" is often confused with that of acute exposure.

Acute Toxicity

A letter and number code that may be added to the basic five-chapter MOS code to identify certain highly specialized skills that are in addition to the skills required by the MOS.

**Additional Skill Identifier
(ASI)**

GLOSSARY OF TERMS

Adsorption	The adhesion of a substance to the surface of another solid or liquid (not to be confused with absorption).
Adverse Effect	A biochemical change, functional impairment, or pathological lesion that impairs performance and reduces the ability of the organism to respond to additional challenge.
Adverse Effect Level (AEL)	An exposure level at which there is statistically or biologically significant increases in frequency or severity of adverse effects between the exposed population and its appropriate control group.
Aerosol	Airborne solid or liquid substance. Aerosols are classified as dusts, fumes, smokes, mists, and fogs according to their physical nature, particle size, and method of generation. The particles may vary from 100 micrometers to 0.01 micrometers in diameter.
Allergic Reaction	Adverse reaction to a chemical resulting from previous sensitization to that chemical or to a structurally similar one.
Alpha Particle	Positively charged particle given off from the nucleus of certain radioactive substances. Alpha particles have a range of approximately 20 micrometers in tissue. They are not an external hazard. They are an internal hazard due to their high specific ionization.
Anecdotal Data	Data based on descriptions of individual cases rather than on controlled studies.
Anthropometric	Of, or relating to, the study of human body measurements, especially on a comparative basis.
Armed Forces Qualification Test (AFQT)	The AFQT is a combination of verbal (VE), arithmetic reasoning (AR), and numerical operations (NO) ASVAB subtests. The AFQT is used to screen applicants whose mental characteristics are not sufficient for Army duties. The AFQT score is a good approximation of an individual's intelligence score.

GLOSSARY OF TERMS

The Armed Services Vocational Aptitude Battery (ASVAB) consists of a series of subtests which, when combined in various ways, produces 11 composite scores. These composites are used for two purposes: selection of applicants and assignment of new accessions. Composites are used to assign new accessions to MOS which have a need for personnel with the requisite aptitudes in specific areas. Most MOS have entry requirements involving a minimum score on one or more of the ASVAB composites. The ASVAB composites are good predictors for entry-level personnel in diagnostic, procedural, administrative, and clerical types of tasks. There is substantial confidence that assignment to job categories by ASVAB composites is considerably better than chance.

**Armed Services Vocational
Aptitude Battery (ASVAB)**

With the cooperation of service schools, the AOSP provides research on each Military Occupational Specialty (MOS). Using soldier tasks as the basic unit of analysis, data are collected on such variables as percent performing, task learning difficulty, and relative time spent. After the survey data have been analyzed, a report on the MOS is prepared.

**Army Occupational Survey
Program (AOSP)**

A computer-developed document that identifies officer and enlisted training requirements. It contains programs for the active Army, Reserve components, other U.S. services, and foreign military.

**Army Program for
Individual Training
(ARPRINT)**

An end item required for the operation, maintenance, and/or transportation of a BOIP item. ASIOE are listed on the BOIP of the item they support. ASIOE have their own LIN and are separately documented TOE/VTAADS.

**Associated Support Items
of Equipment (ASIOE)**

Pertaining to, or involving, the organs of hearing or the sense of hearing.

Auditory

A measure of the degree to which a system is either operating or is capable of operating at any time when used in its typical operational and support environment.

Availability (Operational)

GLOSSARY OF TERMS

Baseline Cost Estimate (BCE)

A document prepared by the materiel developer that provides a detailed estimate of acquisition and ownership costs. It is normally required for high-level decisions and provides the basis for subsequent tracking and auditing.

Basis of Issue Plan (BOIP)

A planning document that lists specific levels at which a new item of materiel may be placed in a unit/organization, the quantity of the item proposed for each organization element, and other equipment and personnel changes required as a result of the introduction of the new item. The BOIP is not an authorization document.

Best Technical Approach (BTA)

A document prepared by a Special Task Force (STF) or Special Study Group (SSG), or jointly by the combat developer and materiel developer during concept exploration. It identifies the best general technical approach based on the results of the Trade-Off Determination (TOD) and an analysis of trade-offs among support and technical concepts, life-cycle costs, and schedules.

Beta Particle

Form of radiation emitted from the nucleus of an atom with a mass and charge equal in magnitude to that of an electron. Beta particles have a limited range in air. For an energetic beta from phosphorus-32, the maximum range in air is 5 meters. The most probable organs to be exposed from external beta radiation are the skin and eyes. Internal exposure from ingestion or inhalation can also pose a hazard.

Bias

Refers to a more or less persistent tendency for measurements, as a group, to be too large or too small.

Biohazard

Infectious agents presenting a risk or potential risk to individuals, either directly through infection or indirectly through disruption of the environment.

Biologic Agents

Cause of occupational disease; may be classified into four groups: viral and rickettsial, bacterial, fungal, and parasitic.

GLOSSARY OF TERMS

Substances to include pathogenic microorganisms, their toxins, and enzymes which cause disease to individuals.

Biological Substances

Wave created by sharp increases in pressure due to compression of the atmosphere. These pressures are those which are exerted by the dense wall of air that comprises the wave front. The wave may be a free field wave or a reverberant wave.

Blast Overpressure (BOP)

A chemical agent (such as sulfur mustard, HD) that produces local irritation and damage to the skin and mucous membranes, progressing in severity to fluid-filled blisters on skin. Damage can be caused by exposure to liquid or vapor, inhalation of which can also produce damage to the respiratory tract.

Blister Agent

A chemical agent (hydrogen cyanide, AC) that is absorbed into the general circulation system and carried to all body tissues. Blood agents deprive tissue cells of oxygen, even though the blood is capable of carrying it. The brain, being highly dependent upon a continual source of oxygenation, is especially susceptible. Clinical signs include hyperventilation, which further enhances the dose received, resulting in abrupt cardiovascular collapse.

Blood agent

The chemical toxin produced by one of seven different strains of Clostridium Botulinum. Botulinum toxin is the most toxic substance known to man and results in disruption of peripheral nerve conduction leading to flaccid paralysis and death due to respiratory failure.

Botulinum Toxin

Poisoning, usually associated with consumption of improperly prepared foodstuffs, caused by the toxin produced by Clostridium Botulinum.

Botulism

That zone of the ambient environment in which a person performs the normal respiratory function.

Breathing Zone

An air sample collected in the breathing area (around the nose) of an individual to assess his/her exposure to airborne contaminants.

Breathing Zone Sample

GLOSSARY OF TERMS

Carcinogen

A chemical substance known to induce neoplastic change (malignancies) in experimental animals and/or man. Four types of response are generally accepted as evidence of induction of neoplasms: (1) an increase in incidence of the tumor types that occur in controls; (2) development of tumors earlier than controls; (3) the occurrence of tumor types not observed in controls; and (4) an increased multiplicity of tumors.

ACGIH

A1—Confirmed Human Carcinogen: The agent is carcinogenic to humans based on the weight of evidence from epidemiologic studies of, or convincing clinical evidence in, exposed humans.

A2—Suspected Human Carcinogen: The agent is carcinogenic in experimental animals at dose levels, by route(s) of administration, at site(s), of histologic type(s), or by mechanism(s) that are not considered relevant to worker exposure. Available epidemiologic studies are conflicting or insufficient to confirm an increased risk of cancer in exposed humans.

Carcinogen Classification Schemes

A3—Animal Carcinogen: The agent is carcinogenic in experimental animals at a relatively high dose, by route(s) of administration, at site(s), of histologic type(s), or by mechanism(s) that are not considered relevant to worker exposure. Available epidemiologic studies do not confirm an increased risk of cancer in exposed humans. Available evidence suggests that the agent is not likely to cause cancer in humans except under uncommon or unlikely routes or levels of exposure.

A4—Not Classifiable as a Human Carcinogen: There are inadequate data on which to classify the agent in terms of its carcinogenicity in humans and/or animals.

A5—Not Suspected as a Human Carcinogen: The agent is not suspected to be a human carcinogen on the basis of properly conducted epidemiologic studies in humans. These studies have sufficiently long follow-up, reliable exposure histories, sufficiently high

GLOSSARY OF TERMS

dose, and adequate statistical power to conclude that exposure to the agent does not convey a significant risk of cancer to humans. Evidence suggesting a lack of carcinogenicity in experimental animals will be considered if it is supported by other relevant data.

Substances for which no human or experimental animal carcinogenic data have been reported are assigned no carcinogen designation.

USEPA

Group A—Human Carcinogen: Sufficient evidence in epidemiologic studies to support casual association between exposure and cancer.

Group B—Probable Human Carcinogen: Limited evidence in epidemiologic studies (Group B1) and/or sufficient evidence from animal studies (Group B2).

Group C—Possible Human Carcinogen: Limited or equivocal evidence from animal studies and inadequate or no data in humans.

Group D—Not Classified: Inadequate or no human and animal evidence of carcinogenicity.

Group E—No Evidence of Carcinogenicity for Humans: No evidence of carcinogenicity in at least two adequate animal tests in different species or in adequate epidemiologic and animal studies.

IARC

Group 1—The agent (mixture) is carcinogenic to humans. The exposure circumstance entails exposures that are carcinogenic to humans. This category is used when there is sufficient evidence of carcinogenicity in humans. Exceptionally, an agent (mixture) may be placed in this category when evidence in humans is less than sufficient but there is sufficient evidence of carcinogenicity in experimental animals and strong evidence in exposed humans that the agent (mixture) acts through a relevant mechanism of carcinogenicity.

GLOSSARY OF TERMS

Group 2. This category includes agents, mixtures, and exposure circumstances for which, at one extreme, the degree of evidence of carcinogenicity in humans is almost sufficient, as well as those for which, at the other extreme, there are no human data but for which there is evidence of carcinogenicity in experimental animals.

Agents, mixtures, and exposure circumstances are assigned to either Group 2A (probably carcinogenic to humans) or Group 2B (possibly carcinogenic to humans) on the basis of epidemiological and experimental evidence of carcinogenicity and other relevant data.

Group 2A—The agent (mixture) is probably carcinogenic to humans. The exposure circumstance entails exposures that are probably carcinogenic to humans. This category is used when there is limited evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals. In some cases, an agent (mixture) may be classified in this category when there is inadequate evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals and strong evidence that the carcinogenesis is mediated by a mechanism that also operates in humans. Exceptionally, an agent, mixture, or exposure circumstance may be classified in this category solely on the basis of limited evidence of carcinogenicity in humans.

Group 2B—The agent (mixture) is possibly carcinogenic to humans. The exposure circumstance entails exposures that are possibly carcinogenic to humans. This category is used for agents, mixtures, and exposure circumstances for which there is limited evidence of carcinogenicity in humans and less than sufficient evidence of carcinogenicity in experimental animals. It may also be used when there is inadequate evidence of carcinogenicity in humans but there is sufficient evidence of carcinogenicity in experimental animals. In some instances, an agent, mixture, or exposure circumstance for which there is inadequate evidence of carcinogenicity in humans but limited evidence of carcinogenicity in experimental animals together with supporting evidence from other relevant data may be placed in this group.

Carcinogen Classification
Schemes continued

GLOSSARY OF TERMS

Group 3—The agent (mixture or exposure circumstance) is not classifiable as to its carcinogenicity to humans. This category is used most commonly for agents, mixtures, and exposure circumstances for which the evidence of carcinogenicity is inadequate in humans and inadequate or limited in experimental animals. Exceptionally, agents (mixtures) for which the evidence of carcinogenicity is inadequate in humans but sufficient in experimental animals may be placed in this category when there is strong evidence that the mechanism of carcinogenicity in experimental animals does not operate in humans. Agents, mixtures, and exposure circumstances that do not fall into any other group are also placed in this category.

Group 4—The agent (mixture) is probably not carcinogenic to humans. This category is used for agents or mixtures for which there is evidence suggesting lack of carcinogenicity in humans and in experimental animals. In some instances, agents or mixtures for which there is inadequate evidence of carcinogenicity in humans but evidence suggesting lack of carcinogenicity in experimental animals, consistently and strongly supported by a broad range of other relevant data, may be classified in this group.

Any person who is lost to the organization by reason of having been declared dead, wounded, injured, diseased, interned, captured, retained, missing, missing in action, beleaguered, besieged, or detained.

Casualty

An airborne concentration of a substance that should never be exceeded.

Ceiling Limit (C)

A chemical substance that is intended for use in military operations to kill, seriously injure, or incapacitate people through its physiological effects. Included are blood, nerve, choking, blister, and incapacitating agents. Excluded are riot control agents, chemical herbicides, and smoke and flame materials.

Chemical Agent

An individual who has been affected sufficiently by a chemical agent to prevent or seriously degrade his or her ability to carry out the mission.

Chemical Agent Casualty

GLOSSARY OF TERMS

Chemical Cartridge	Type of absorption unit used with a respirator for removal of solvent vapors and certain gases.
Chemical Substance	Usually associated with some description of their toxicity or exposure hazard, includes solids, liquids, mists, vapors, fumes, gases, and particulate aerosols. Exposure via inhalation, ingestion, or contact with skin or eyes may cause toxic effects, usually in a dose-dependent manner.
Chronic Effects	Effects that may arise after months or years and have a long course. The effects may range from relatively mild to severe.
Chronic Exposure	Multiple or continuous exposures occurring over an extended period of time, or a significant fraction of the individual's lifetime.
Chronic Study	A toxicity study designed to measure the (toxic) effects of chronic exposure to a chemical.
Chronic Toxicity	Effects that persist over a long period of time whether or not they occur immediately or are delayed. The term "chronic toxicity" is often confused with that of chronic exposure and is often used to describe delayed toxicity.
Combat Developer (CBTDEV)	Command or organization responsible for formulating concepts doctrine, organization, materiel objectives, requirements, and user tests and evaluations.
Concentration	The total quantity of substance present in a given unit volume (of gas or liquid). May be expressed in any unit of mass per unit of volume such as milligrams per cubic meter (mg/m ³), grams per liter (gm/L), or as volume per volume such as parts per million (ppm).
Concept Formulation Package or Process (CFP)	The documentary evidence that the concept formulation effort has satisfied the concept formulation objectives. The package consists of a Trade-Off Determination (TOD), Trade-Off Analysis (TOA), Best Technical Approach (BTA), and Cost and Operational Effectiveness Analysis (COEA).

GLOSSARY OF TERMS

Transfer of heat by physical contact between substances.

Conduction

A condition or variable that may be a factor in producing the same response as the substance under study. The effects of such factors may be discerned through careful design and analysis.

Confounder

Standards prepared and written by industry, regulatory, and general interests groups. Based on known, available data, the standards reference the construction, usability, and safety of a product.

Consensus Standards

An impurity in water, soil, materials, etc.

Contaminant

To introduce an impurity into water, soil, materials, etc.

Contaminate

Deposit, adsorption, or absorption of radioactive, biological, or chemical substances on and by structures, areas, personnel, objects, soil, and water. Food and/or water made unfit for human or animal consumption by the presence of radioactive, chemical, or biological substances.

Contamination

Ceiling concentrations designed to avoid adverse health effects, either immediate or delayed, of more prolonged exposures and to avoid degradation in crew performance that might endanger the objectives of a particular mission as a consequence of continuous exposure for up to 90 days.

**Continuous Exposure
Guidance Level (CEGL)**

A form (DD Form 1423) used as the sole list of data and information that the contractor is obligated to deliver under the contract, with the exception of that data required by standard Defense Acquisition Regulation (DAR) clauses.

**Contract Data
Requirements List (CDRL)**

Transfer of heat through a liquid or gas by the actual movement of the molecules.

Convection

The COEA evaluates the costs and benefits (i.e., the operational effectiveness or military utility) of alternative courses of action to meet recognized defense needs. Early life-cycle cost estimates of

**Cost and Operational
Effectiveness Analysis
(COEA)**

GLOSSARY OF TERMS

the competing alternatives are analyzed relative to the value of the expected increase in operational capability for each alternative. This analysis facilitates comparisons of the alternative concepts. Trade-offs are made among cost, schedule, and performance as a result of this analysis.

**Cost and Training
Effectiveness Analysis
(CTEA)**

A methodology that involves a documented investigation of the comparative effectiveness and costs of alternative training systems for attaining defined performance objectives, taking into consideration usage pattern and training scenarios. A CTEA can examine training concepts, equipment, and strategies; programs of instruction; and training implications of new materiel, organization, tactics, employment techniques, or families of systems. CTEA is used in conjunction with the COEA.

Criterion

A criterion represents the best scientific estimate of an environmental concentration of a contaminant corresponding to a given level of hazard, which in the case of noncancer toxicity represents a level that is expected to cause no additional health risk.

Critical Issue

Those issues associated with the development of an item or system that are of primary importance to the decision authority in deciding whether to allow the item or system to continue into the next phase of development.

Critical System Criteria

Critical system characteristics are those design features that determine how well the proposed concept or system will function in its intended environment.

Critical System Functions

Critical system functions are those that the system must perform in order to carry out its intended mission.

Ct Value

A measure of vapor or gas exposure by inhalation. It is a product of the concentration (C) usually expressed in mg/m^3 and duration of exposure (t) in minutes. The resulting (and somewhat confusing units) are $\text{mg min}/\text{m}^3$. It is important to recognize that this is not simple algebra; predictions of toxic effects should never be extrapo-

GLOSSARY OF TERMS

lated beyond twice, or less than half, *known* toxic exposure data. (Exposure to 1 mg/m³ for 20 minutes; 2 mg/m³ for 10 minutes; or 4 mg/m³ for 5 minutes are all valid extrapolations of 2 minute exposure data. All three equate to a Ct of 20 mg min/m³.)

In nuclear fission, the product nucleus or atom that results from the decay of the parent.

Daughter

Sound level in decibels read on the A-scale of a sound level meter. The A-scale discriminates against very low frequencies (as does the human ear) and is, therefore, better for measuring general sound levels.

dBA

Sound level in decibels read on the C-scale of a sound level meter. The C-scale discriminates very little against low frequencies.

dBC

A unit used to express sound power level. Sound power is the total acoustic output of a sound source in watts.

Decibel (Db)

To breakdown, neutralize, or remove a radioactive, chemical, or biological substance that poses a hazard to personnel or equipment.

Decontaminate

The DAES is designed to provide, on a regular and systematic basis, advance indications of both potential and actual program problems before they become significant. Recognizing that problems are expected to surface in these programs aids in communication and early resolution. The report reflects the most current status of the program with comment on actual or projected changes in the appropriate sections.

**Defense Acquisition
Executive Summary (DAES)**

Inflammation of the skin from any cause.

Dermatitis

A program designated by the AAE for ASARC milestone review. Selection is based on resource requirements, complexity, and Congressional interest.

**Designated Acquisition
Program (DAP)**

GLOSSARY OF TERMS

Detection Limit	Analytical capability based on the amount of the sample and the sensitivity of the analytical method.
Development Testing (DT)	Testing of materiel systems conducted by the materiel developer using the principle of a single, integrated development test cycle to demonstrate that the design risks have been minimized; the engineering development process is complete; and the system meets specifications. Also used to estimate the system's military utility when it is introduced. DT is conducted in factory, laboratory, and proving ground environments.
Diffusion	Process of spontaneous intermixing of different substances due to molecular motion and tending to produce uniformity of concentration.
Disinfection	The destruction and removal of pathogenic organisms, especially by means of chemical substances.
Dosage	The determination and regulation of the size, frequency, and number of doses of a drug or toxicant. Often used to refer to the total, cumulative exposure equivalent that an individual receives when exposed to a toxic substance over a period of time.
Dose	The amount of energy or substance absorbed in a unit volume or an organ or individual.
Dose Response	Characteristics of exposure to a substance and the spectrum of effects.
Dose Response Relationship	A relationship between (1) the dose, often actually based on an "administered dose" (i.e., exposure) rather than absorbed dose, and (2) the extent of toxic injury produced by that chemical. Response increases with increasing dose, and can be expressed either as the severity of injury or proportion of exposed subjects affected.
Dust	Any solid particulate matter from 1 to 150 microns in diameter.

GLOSSARY OF TERMS

A "lessons learned" approach to identify manpower, personnel, and training resource intensive tasks (high drivers) on current system that must be resolved in new or product improved systems. By-products of the methodology are initial MPT constraints and input to target audience description.

**Early Comparability
Analysis (ECA)**

The dose of a substance that produces a given, defined therapeutic or toxic effect in 50 percent of the exposed population. NOT A 50 PERCENT EFFECT! This is a quantal (yes/no) determination, but can be applied to graded effects if they are defined in a quantal manner (e.g., the dose of drug necessary to decrease diastolic blood pressure by 10 mm Hg in 50 percent of the subjects). Under these circumstances, it is imperative that the assumptions and definition of "effect" be stated with the dose.

**ED₅₀ (Median Effective
Dose)**

Training that results from features designed and built into a specific end item of equipment to provide training in its use.

Embedded Training (ET)

A rare and unexpected situation with potential for significant loss of life, property, or mission accomplishment.

Emergency

A concentration of a substance in air (as a gas, vapor, or aerosol) that will permit continued performance of specific tasks during rare emergency conditions, lasting for periods of 1-24 hours. Should not be used for planned exposures because EEGLs are neither safe nor hygienic.

**Emergency Exposure
Guidance Level (EEGL)**

A response measure in a toxicity study.

Endpoint

A file that contains personnel record data on all enlisted personnel. From this file, qualification data can be obtained for every soldier in any MOS.

Enlisted Master File (EMF)

The external surroundings and influences.

Environment

In study of measurements, "error" does not mean "mistake," but is a technical term denoting deviations from the average or some other

Error

GLOSSARY OF TERMS

computed quantity. Such deviations are considered to be random errors. Bias involves the notion of constant error.

Estimate

A numerical value calculated from data. The average is an estimate of the quantity under measurement. Other parameters such as the standard deviation are often estimated from the data.

Etiologic Agent

A viable microorganism or its toxin that causes, or may cause, human disease.

Evaporation

Change of a liquid into a gas at any temperature below its boiling point.

Exposure

Amount of chemical that enters the body by some route, for a specified frequency and duration.

Exposure Assessment

Process that takes into account the chemical and physical properties of the substance, the effect the substance produces, the exposure frequency and duration, and the affected subject.

Exposure Routes

Major routes of exposure include ingestion, inhalation, and absorption through the skin.

Extrapolation

An estimate of response or quantity at a point outside the range of the experimental data. Also refers to the estimation of a measured response in a different species or by a different route than that used in the experimental study of interest (i.e., species to species, route to route, acute to chronic, high to low).

Extremely Low Frequency (ELF)

Electromagnetic radiation including both electric and magnetic fields in the frequency range of 0 to 300 hertz.

Filter, HEPA

High-efficiency particulate air filter that is at least 99.97 percent efficient in removing particles with a diameter of 0.3 microns.

First Article Test (FAT)

Production testing that is planned, conducted, and monitored by the materiel developer. FAT includes preproduction and initial

GLOSSARY OF TERMS

production testing conducted to ensure that the contractor can furnish a product that meets the established technical criteria.

The first troop unit to be equipped with the first production items/systems.

First Unit Equipped (FUE)

The scheduled date a system or end item and its support elements are issued to the designated initial operational capability unit, and training specified in the new equipment training plan has been accomplished.

**First Unit Equipped (FUE)
Date**

Condensation of water vapor in the air.

Fog

Testing conducted subsequent to the full production decision to provide data to answer operational issues that were not resolved by earlier operational testing.

Follow-on Evaluation

A Milestone III production decision to obtain information lacking from earlier initial operational test and evaluation. Normally, FOT&E is conducted subsequent to the decision to proceed beyond low rate initial production.

**Follow-on Operational T&E
(FOT&E)**

The FP is the representative of the Army Staff Agency responsible for the subject area in which Information Mission Area (IMA) resources are utilized or to be utilized for Major Automated Information Systems Review Council (MAISRC) level systems.

Functional Proponent (FP)

Solid particles from 0.2 to 1 micron in diameter, formed as vapors condense or as chemical reactions take place.

Fume

Electromagnetic emission of short wavelength from the nucleus of an atom. They range in energy from 10 keV to 9 MeV. Since gamma radiation can penetrate matter to a greater extent than either alpha or beta radiation, it is both an internal and external hazard.

Gamma Radiation

A state of matter in which the material has very low density and viscosity.

Gas

GLOSSARY OF TERMS

Half-life

The period of time required for one-half of the nuclei of a given radioactive substance to decay. Each radionuclide has a unique half-life.

Hardware versus manpower comparability methodology (HARDMAN I and II)

The Army HARDMAN comparability methodology is a structured approach to the determination of the manpower, personnel, and training resource requirements for a conceptualized materiel system. Additionally, the methodology estimates the impact of these MPT requirements on system effectiveness and life-cycle costs. HARDMAN I is entirely manual. HARDMAN II uses a large software program that runs on a mainframe computer. The objective of using this methodology is to provide Army decision makers with information on competing design proposals in order to assess the supportability of each from an MPT standpoint. Although the methodology can be applied at later phases of the materiel acquisition process, it is most effective prior to Milestone I.

HARDMAN versus manpower methodology (HARDMAN III)

HARDMAN III is a PC-based family of models used for addressing manpower, personnel, and training in the context of total system performance (effectiveness and availability). Each of the six modules in the family is designed for independent use: SPARC allows the user to construct a manned system simulation model; M-CON determines the likely MOS selections that will be made for a new system and identifies the available number of soldiers in each MOS. P-CON identifies the likely characteristics of the soldiers who will be in those MOSs when the system is fielded and provides estimates of the time and accuracy of their performance of relevant military tasks. T-CON provides an estimate of the training likely to be selected for the system. MAN-SEVAL allows the estimation of quantitative manpower measurements within scenarios. PER-SEVAL estimates the minimum soldier aptitude required to achieve the total system performance requirements.

Hazard Minimization (HAZMIN)

Minimization of the amount of waste generated by a product or process.

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Any substance that has been determined by OSHA as having the potential to cause a physical or health hazard. This is based on its potential for burning, exploding, or otherwise causing an injury to workers or the likelihood that exposure to it will result in acute or chronic health effects among employees.

Hazardous Material

Any solid waste that is either included on EPA's list of hazardous wastes or exhibits any of the following characteristics: ignitability, corrosivity, reactivity, or toxicity.

Hazardous Waste

The likelihood that a hazard will occur. It is based on an assessment of such factors as location, exposure frequency and duration, and affected population.

Hazard Probability

A, Frequent—likely to occur frequently for a specific individual item; will continuously experience for a fleet or inventory.

B, Probable—will occur several times in the life of a specific individual item; will occur frequently for a fleet or inventory.

C, Occasional—likely to occur sometime in the life of a specific individual item; will occur several times for a fleet or inventory.

**Hazard Probability
Categories**

D, Remote—unlikely but possible to occur in the life of a specific individual item; unlikely but can reasonably be expected to occur for a fleet or inventory.

E, Improbable—so unlikely it can be assumed occurrence may not be experienced in the life of a specific individual item; unlikely to occur but possible for a fleet or inventory.

An assessment of the worst potential consequence (i.e., degree of bodily injury, occupational illness, health-related performance degradation, or bodily system damage which could occur) prior to the implementation of recommendations to eliminate or minimize the hazard.

Hazard Severity

GLOSSARY OF TERMS

Hazard Severity Categories

Category I, Catastrophic—Hazard may cause death or total loss of a bodily system.

Category II, Critical—Hazard may cause severe bodily injury, severe occupational illness, or major damage to a bodily system.

Category III, Marginal—Hazard may cause minor bodily injury, minor occupational illness, or minor damage to a bodily system.

Category IV, Negligible—Hazard would cause less than minor bodily injury, minor occupational illness, or minor bodily system damage.

Health Hazard

An existing or likely condition, inherent to the operation or use of materiel, that can cause death, injury, acute or chronic illness, disability, or reduced job performance of personnel by exposure to acoustical energy, biological substances, chemical substances, oxygen deficiency, radiation energy, shock, temperature extremes, trauma, and vibration.

Health Hazard Assessment

The application of biomedical knowledge and principles to document and to quantitatively determine the health hazards of systems. This assessment identifies, evaluates, and recommends solutions to control the risks to the health and effectiveness of personnel who test, use, or service Army systems. This assessment includes the evaluation of hazard severity, hazard probability, risk assessment, and operational constraints; the identification of required precautions and protective devices; and training requirements.

Health Hazard Assessment Report (HHAR)

The formal report documenting, for a given system, the assessment of health hazard issues and risks, recommended preventive or control actions, and recommended training requirements.

Health Hazard Domain Report (HHDR)

The HHDR is one of the seven domain reports made under the MANPRINT program. Its purpose is to identify potential health hazards that may be associated with the development, acquisition, operation, and maintenance of Army systems. This identification

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will be done early in the system life cycle to preserve and protect the humans who will operate, maintain, and support the equipment; enhance total system effectiveness; reduce system retrofit needed to eliminate health hazards; and reduce personnel compensation. Data from this report is input to the MANPRINT Integration Report and the System MANPRINT Management Plan.

Published documents specifying conditions of acceptable risk for individual health hazards. These can include medical exposure limits, health conservation criteria, and materiel design standards.

Health Standards

Illness due, in part, to excessive loss of salt during sweating. Results in painful muscle spasms in the extremities, back, and abdomen.

Heat Cramps

Illness due to circulatory failure in which venous blood returned to the heart is significantly reduced. Fainting may result. Failure is caused because the individual's blood supply is not adequate to serve both heat regulation and other bodily needs.

Heat Exhaustion

Natural physiological response reaction of the body to the application of heat stress.

Heat Strain

Relative amount of thermal strain from the environment.

Heat Stress

Illness due to the body temperature reaching a level where sweating stops. The body temperature can then rise to critical levels causing tissue damage and death.

Heat Stroke

A task identified, through analysis of task criteria, as costly in manpower, personnel, and training resources. The primary objective of ECA is to aid combat developers in identifying "high drivers" requiring a design change so that these tasks can be reduced in number or completely eliminated from new system design. Information from tasks derived from predecessor or reference systems are the key to determining the impact these tasks have on the Army MPT resources.

High Driver Task

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**Human Engineering
Domain Report (HEDR)**

The HEDR is one of the seven domain reports made under the MANPRINT program. Its purpose is to assess the human-machine interface in terms of both human engineering technology and total system performance. Data from this report is input to the MANPRINT Integration Report.

**Human Factors Engineering
(HFE)**

A comprehensive technical effort to integrate all personnel characteristics (skills, training implications, behavioral reactions, performance, anthropometric characteristics, and biomedical factors) into Army doctrine and systems.

**Human Factors Engineering
Assessment (HFEA)**

HFEA deals with the comprehensive integration of soldier characteristics into Army doctrine and systems. It is used in system definition, design, development, and evaluation in order to optimize the capabilities and performance of human machine combinations. It includes the principles and techniques of the science of human engineering, and covers all aspects of the soldier-machine interface. Application of human factors engineering assessments involves considerations of all relevant information pertaining to the following: human characteristics, anthropometric data, system interface requirements, human performance, biomedical factors, and safety factors. In addition, human factors engineering assessments pertaining to system manning levels and user, operator and maintainer capability requirements are used as inputs to the consideration of manpower, personnel, and training issues in the MAP. The adequacy of system HFE is evaluated during both development and operational testing.

Hypersensitivity

Exaggerated response by the immune system to an allergen. Sometimes used incorrectly in a nonimmune sense to indicate increased susceptibility to the effects of a pollutant.

Ict₅₀

Inhalation dose of a chemical agent (vapor or aerosol) that produces a given, defined level of "incapacitation" in 50 percent of the exposed subjects (see ED₅₀, and consider "incapacitation" as the effect). NOTE: There is no general consensus on a military definition of incapacitation. It can refer to behavioral manifestations,

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physiologic endpoints, or individual combat effectiveness, all of which may vary depending upon the task the individual soldier is expected to accomplish.

Dose of a liquid chemical agent needed to produce "incapacitation" in 50 percent of the exposed subjects (see note under Ict_{50}).

ID₅₀

A genetically determined abnormal reactivity to a chemical.

Idiosyncratic Reaction

Immediate effects occur or develop rapidly after a single administration of a substance, while delayed effects are those that occur after the lapse of some time. These effects have also been referred to as acute and chronic, respectively.

Immediate versus Delayed Toxicity

Unable to perform normal activities or tasks.

Incapacitate

A chemical agent that produces a temporary disabling condition that persists for hours to days after exposure has ceased.

Incapacitating Agent

The concentration/dose that renders an individual unable to perform normal activities or tasks.

Incapacitating Dose

The number of new cases of a disease within a specified period of time or dose.

Incidence

The rate at which new cases of a disease or condition develop within a specified period of time or dose.

Incidence Rate

Personnel, independent of materiel developers and combat developers, who provide health hazard assessment support of Army materiel systems.

Independent Medical Assessor

The probability that an individual person will experience an adverse effect. This is identical to population risk unless specific population subgroups can be identified that have different (higher or lower) risks.

Individual Risk

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Infectious

Pathogens of sufficient virulence and quality capable of causing disease in an exposed susceptible host.

Infrared Radiation

Those wavelengths of biological interest with wavelengths in the spectral region of 760 to 1000 nanometers. The eye is the critical organ.

Injury

A specific impairment of body structure or function caused by an outside agent or force, which may be physical or chemical.

In Process Review (IPR)

Reviews of Army acquisition programs other than DOD major or Army Designated Acquisition Programs.

Integrated Logistics Support (ILS)

A composite of all support considerations necessary to assure the effective and economical support of a system at all levels of maintenance for its programmed life cycle. A unified and iterative approach to the management and technical activities needed to:

- Influence operational and materiel requirements and design specifications.
- Define the support requirements best related to system design and to each other.
- Develop and acquire the required support.
- Provide required operational phase support at lowest cost.
- Seek readiness and LCC improvements in the materiel system and support systems during the operational life cycle.
- Repeatedly examine support requirements throughout the service life of the system.

Integrated Logistics Support Plan (ILSP)

Provides a composite of all support considerations necessary to assure the effective and economical support of a system for its life cycle and serves as the source document for summary and consolidated information required in other program management documentation.

Integrated Program Summary (IPS)

The IPS with its annexes is the primary decision document used to facilitate top-level acquisition milestone decision making. It

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provides a comprehensive summary of program structure, status, assessment, plans, and recommendations by the program manager and the program executive officer.

The process of estimating equivalent doses between species (e.g., frequently a known animal dose is converted to estimate an equivalent human dose). The EPA's cancer risk assessment guidelines generally recommend using the surface area approach unless there is evidence to the contrary. The dose as mg/kg of body weight/day divided by a 10-fold uncertainty factor is generally used to convert between species for noncancer effects of chemicals.

**Interspecies Dose
Conversion**

Radiation sufficiently energetic to cause ionization of molecules when interacting with living or inanimate matter. This includes alpha and beta particles, gamma rays, x-rays, and—indirectly—neutrons.

Ionizing Radiation

A substance that produces an irritating effect when it contacts skin, eyes, nose, or respiratory system.

Irritant

A variation of an element having the same atomic number as the element itself but a different atomic weight because of the number of neutrons. The chemical properties of isotopes for an element are essentially the same. The term is not a synonym for radionuclide. Some isotopes are stable and others are radioactive.

Isotope

The basic method used to obtain salient facts about a job, involving observation of workers, conversations with those who know the job, analysis questionnaires completed by job incumbents, and study of documents involved in performance of the job.

Job Analysis

The JTA is a requirements/authorization document of equipment for units operated jointly by two or more military services, such as MAAG and missions.

**Joint Table of Allowances
(JTA)**

Light amplification by stimulated emission of radiation. Wave form may be either a continuous or pulsed wave. Laser devices

Laser

GLOSSARY OF TERMS

containing a crystal, gas, or other suitable substance stimulate atoms by focused light waves and amplify and concentrate these waves. They are then emitted as a narrow, very intense coherent beam.

Laser Light Region

A portion of the electromagnetic spectrum, which includes ultraviolet, visible, and infrared light. Optical wavelengths are in the electromagnetic spectrum of 100 nanometers to 1 millimeter. The eye and skin are primary critical organs for laser radiation exposure.

LC₅₀ (Median Lethal Concentration)

Dosage of a substance by inhalation that results in death in 50 percent of the exposed population.

LD₅₀ (Median Lethal Dose)

Dose of a substance that produces death in 50 percent of the exposed population. Usually as a single dose, with the route of exposure specified.

Learning Analysis

A procedure for identifying the supporting skills and knowledge of each stated objective that must be acquired before a soldier can demonstrate mastery of the objectives.

Life Cycle System Management Model (LCMM)

An integrated model of phases, activities, documentation, and decision points guiding the acquisition of Army materiel.

Life Cycle System Management Model Phases

Phase 0—Concept Exploration and Definition. The purpose of this phase is to conduct competitive, parallel short-term studies in order to define and evaluate the feasibility of alternative concepts. It also provides supporting analyses and information necessary to assess the relative merits of the concepts at the Milestone I, Concept Demonstration Approval, decision point. Alternative system design and support concepts are explored within the context of the mission need and program objectives. Emphasis is on generating innovative and conceptual competition from industry research and development; foreign research, depots, arsenals, and government research; and development and engineering centers and laboratories.

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Phase 1—Demonstration and Validation. During this phase, program risk is identified and reduced as much as possible before making the crucial decision on selecting a proposed system concept that best meets program objectives and whether to enter Engineering and Development with the intent eventually to deploy. This phase focuses on defining critical design characteristics (to include manpower, personnel, and training constraints), addressing manufacturing technologic deficiencies, and assessing production feasibility. Analysis, simulation models, or prototypes are used to optimize design and resolve problems.

Phase 2—Engineering and Manufacturing Development. The purpose of Engineering and Manufacturing Development is to design, fabricate, test, and evaluate a complete system. This includes the principal items necessary for its production, operation, and support. RAM design, testing, and evaluation of components should be integrated into the earliest part of this phase. When making design trade-offs, it is not standard practice to design either to the performance floor or to the cost ceiling. Trade-offs are done in a manner that gives optimal overall system cost effectiveness. Simplicity is emphasized as opposed to sophistication. High priority is placed on ensuring adequate quantities of equipment can be afforded.

Phase 3—Production and Deployment. Successful completion of TT, OT, and Milestone III approval permit production at rates based on manufacturing efficiency, operational demand, and resource availability. Initial production items are used for production test and follow-on evaluation as necessary. Production will not, however, be suppressed to await completion of follow-on Operational Test and Evaluation. A validated Technical Data Package (TDP) is essential for use in competitive procurement. Therefore, initial production normally will be conducted by the MATDEV. Production rights ordinarily are obtained by the government. Where economies can be achieved, second production sources will be established at the earliest possible date, after a proven TDP is available.

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*Life Cycle System
Management Model Phases
continued*

Phase 4—Operation and Support. During this phase, the materiel system is operated, supported, and maintained in accordance with its intended operational concept. An analysis of the system is conducted to ensure it meets the original requirements and to identify areas for continued improvement in cost, performance reliability, and capability of the system. The system is sustained in the active inventory until a decision is made for upgrade, replacement, or disposal.

**Local versus Systemic
Toxicity**

Local effects refer to those that occur at the site of entry (e.g., lungs, stomach) of a toxicant into the body; systemic effects are those that are elicited after absorption and distribution of the toxicant from its entry point to a distant site.

**Logistic Support Analysis
(LSA)**

An analytical technique used by integrated logistic support management to provide a continuous dialogue between designers and logisticians. LSA provides a system to identify, define, analyze, quantify, and process logistics support requirements for materiel acquisition programs.

**Logistic Support Analysis
Record (LSAR)**

A file of logistic support information in standardized format on acquisition programs for specific new or modified systems and equipment. Serves acquisition process by using logistic data derived during all phases of the process to support logistic support analysis processes.

**Long Range Research,
Development, and
Acquisition Plan (LRRDAP)**

Two basic plans make up the overall Army Long Range Plan: the LRRDAP and the AMC LRRDAP. The *LRRDAP* displays R&D programs in support of requirements identified by the MAA and summarized in the Battlefield Development Plan, portrays programs over a 15-year period, displays RDT&E programs that support procurement, is fully compatible with the PPBES, reflects a by-year prioritization, and is the starting point for RDA program building. The *AMC LRRDAP* consists of two parts: the AMC Long Range Science and Technology Plan and the AMC Long Range Development and Acquisition Plan. The AMC Long Range Science and Technology Plan defines technology in terms of deliverables to

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solve system deficiencies identified by MAA, provides a document that identifies technology base efforts (6.1, 6.2, and 6.3A) being conducted by major subordinate commands and laboratories, provides management a baseline for decisions affecting technology base efforts, and serves as a means of communicating to the user those technologies that will improve mission performance in the 10 to 20-year future. The AMC Long Range Development and Acquisition Plan specifies system development time lines and the relationship between the technical base and planned developments and acquisitions.

Same as LOAEL.

Lowest-Effect Level (LEL)

The lowest exposure level at which there are statistically or biologically significant increases in frequency or severity of adverse effects between the exposed population and its appropriate control group.

**Lowest-Observed-Adverse
Effect Level (LOAEL)**

Meter(s).

m

The personnel strength (military and civilian) as expressed in terms of the number of men and women available to the Army. Manpower refers to the consideration of the net effect of Army systems and items on overall Army human resource requirements and authorizations (spaces) to ensure that each system is affordable from the standpoint of manpower. It includes analysis of the number of people needed to operate, maintain, and support each new system being considered or acquired, including maintenance and supply personnel and personnel to support and conduct training. It requires a determination of the Army manpower changes generated by the system, comparing the new manpower needs with those of the old system(s) being replaced, and an assessment of the impact of the changes on the total manpower limits of the Army. If, given manpower priorities established by the Department of the Army, systems cannot be supported by projected manpower resources, then changes in system design, organization, or doctrine are made to achieve affordability. In the MAP, manpower analyses and actions

Manpower

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are necessarily conducted in conjunction with force structure and budget processes.

**Manpower and Personnel
Integration (MANPRINT)**

The process of integrating the full range of manpower, personnel, training, human engineering, health hazard, system safety, and soldier survivability to improve individual performance and total system performance throughout the entire system development and acquisition process.

**Manpower Requirements
Criteria (MARC)**

The number of direct workers required to effectively perform a specified work activity. A principal computational component of MARC is the estimate of Annual Maintenance Man Hours (AMMH) and its variations (AAMMH, IPAMMH, and DPAMMH), each of which represents different contributing factors to the overall maintenance manpower and personnel determination. AAMMH, AMMH, DPAMMH, and IPAMMH are MARC components of a system from the perspective of the factors each represents. These MARC components are defined below:

Annual Available Maintenance Man Hours (AAMMH). The number of annual man hours each repairer is expected to be available under sustained operating conditions (e.g., wartime).

Annual Maintenance Man Hours (AMMH). The sum of the direct and indirect productive time required to repair an item.

Direct Productive Annual Maintenance Man Hours (DPAMMH). The estimated wrench-turning time required to repair a component or assembly.

MANPRINT Assessment

A MANPRINT Assessment is conducted prior to each milestone decision review for all materiel acquisitions, including materiel change and NDI. The MANPRINT Assessment is used to determine the status and adequacy of the MANPRINT effort in a materiel acquisition program. The assessment also provides a forum for presenting unresolved MANPRINT issues and concerns to decision makers. ODCSPER is responsible for the MANPRINT Assessment

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of ACAT I and II systems. AMC, TRADOC, and the applicable MACOM are responsible for assessments of ACAT III and IV systems.

A critical issue may be either a *system characteristic* (e.g., "weight less than 35 pounds when rigged for carry") or a *detailed performance requirement* (e.g., "process at least 30 standard message blocks per hour without error").

MANPRINT Critical Issue

Exit criteria are specific minimum requirements, capable of empirical, objective measurement that must be demonstrated before a system or program may transition to the next phase of its acquisition process. MANPRINT exit criteria typically link soldier performance and its principal antecedents (personnel aptitudes, training, and soldier survivability) to total system performance, becoming, for a particular acquisition phase, a priority subset of total system requirements. However, they could also be written to require demonstration of a particular outcome (e.g., a performance-based demonstration of the feasibility of a particular training concept). MANPRINT exit criteria are normally written by the MJWG (often in coordination with the TIWG) and are approved by the approval authority for the SMMP.

MANPRINT Exit Criteria

A MANPRINT Integration Report for a system integrates the results of all seven domain assessments into a single document for input to the decision review process. A MANPRINT Integration Report will be prepared prior to milestone decision reviews on all acquisition programs, including materiel change and nondevelopmental items. MANPRINT Integration Reports will be prepared by PERSCOM (DCSPLANS) for major automated information systems (MAIS) and by ARL-HRED for materiel systems.

MANPRINT Integration Report

A multiagency group constituted to manage and integrate MANPRINT activities for a given materiel system.

MANPRINT Joint Working Group

A MANPRINT review is conducted in conjunction with scheduled ILS management team (ILSMT) reviews. The MANPRINT review

MANPRINT Review

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determines the adequacy and status of the MANPRINT efforts associated with each acquisition program. Responsibility for conducting these reviews rests with the applicable program sponsor (i.e., the program manager for ACAT I and II systems; project officer or equivalent for ACAT III and IV systems). Results are documented in the appropriate decision documents.

Man-system Integration

The technical process of integrating the human operator with a materiel system to ensure safe, effective operability and supportability.

Manufacturer's MANPRINT Management Plan (MMMP)

The MMMP is the single document used to record a contractor's technical management of a MANPRINT program. The plan may stand alone, or may be part of another document or data item.

Market Investigation

The process of gathering information before making acquisition decisions. It is conducted initially during the Requirements/Technology Base Activities Phase and, in greater depth, during the Proof-of-Principle Phase.

Materiel Acquisition

The process of acquiring supplies and equipment, facilities, and services, including life cycle systems management of hardware and software, formulation of requirements, research, development, testing, procurement, production, fielding, operation, support, and disposal.

Materiel Acquisition Decision Process (MADP)

The formal process for reviewing a program or project at critical points (Milestone Decision Reviews/In-Process Reviews) to evaluate status and make recommendations to the decision authority.

Materiel Developer (MATDEV)

Command or organization responsible for developing or modifying materiel.

Medical Contaminant Criteria

The varying amounts of contaminants and durations of exposure at which specific adverse effects to health occur.

Medical Contaminant Standards

The prescribed level of a contaminant which cannot be exceeded.

GLOSSARY OF TERMS

Milligram(s).

mg

Milligram-minutes per cubic meter. It is a product of the concentration of a substance in milligrams per cubic meter times the exposure time in minutes.

mg-min/m³

A unit of measurement equal to 1/1,000,000 of a meter.

Micron

A minute organism which includes microbes, bacteria, cocci, viruses, molds, etc.

Microorganism

Electromagnetic spectrum of biological interest with frequencies of 300 megahertz to 300 gigahertz corresponding to wavelengths in the range of 1 millimeter to 1 meter. Wave form may be either a continuous or pulsed wave. The primary effect is thermal in nature. Tissue is susceptible, with the eye the most susceptible to injury.

Microwave Radiation

Decision reviews held to determine whether a program moves forward to the next phase of the LCSMM. The decision reviews may be either Army Systems Acquisition Review Council (ASARC), Defense Acquisition Board (DAB), or In-Process Review (IPR) forums depending on the acquisition category assigned to the system. The milestones are:

Milestone 0—Concept Studies Approval. This milestone determines whether a program advances to Phase 0, Concept Exploration and Definition.

Milestones

Milestone 1—Concept Demonstration Approval. This milestone determines whether a program advances to Phase 1, Demonstration and Validation.

Milestone 2—Development Approval. This milestone determines whether a program advances to Phase 2, Engineering and Manufacturing Development.

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Milestone 3—Production Approval. This milestone determines whether a program advances to Phase 3, Production and Deployment.

Milestone 4—Major Modification Approval. This milestone determines whether a program may need modifications once it has been produced and deployed.

Military Occupational Specialty (MOS)

A term used to identify a grouping of duty positions possessing such close occupational or functional relationship that an optimal degree of interchangeability among persons so classified exists at any given skill level.

Mishap Data Base

The Army Safety Management Information System (ASMIS) is available to a wide variety of computer terminals or minicomputers via voice grade telephone lines and provides for rapid access of information from safety offices throughout the Army. ASMIS consists of data recorded from preliminary reports of aviation mishaps (PRAM), Federal Employees Compensation Act data, aviation flying hours, and the safety library.

Mission Area Analysis (MAA)

An assessment of the capability of a force to perform within a particular battlefield or functional area. The analysis is designed to discover deficiencies in doctrine, training, organizations, and materiel, and to identify means of correcting these deficiencies. MAA also provides a basis for applying advanced technology to future Army operations.

Mission Area Development Plan (MADP)

Transitions the MAA corrective actions to specific projects with milestone schedules so that resources can be applied to the elimination of the MAA deficiency. Each mission area proponent (TRADOC school) publishes an MADP annually. An MADP contains sections on materiel, doctrinal, organizational, and training corrective actions.

Mission Need Statement (MNS)

The MNS is a broad statement of mission need, expressed in terms of an operational capability, not a system-specific solution. The

GLOSSARY OF TERMS

MNS identifies and describes the mission need or deficiency in terms of mission, objectives, and general capabilities.

Liquid particles up to 100 microns in diameter.

Mist

Millimeter(s).

mm

The application of manpower, personnel, and training analytical tools/methodologies to a system to determine MPT constraints, identify current or potential issues, and estimate MPT requirements. Analysis results are used to prepare the MPT Domain Report and furnish MPT data to the MJWG. Examples of such tools are Early Comparability Analysis, HARDMAN I, JASS, CRDS, and HARDMAN III.

MPT Analysis

Determines the status and adequacy of MPT analysis efforts in the systems acquisition program and presents any unresolved MPT issues or concerns to the decision makers at the appropriate decision points. Data from this report is input to the MANPRINT Integration Report.

MPT Domain Report

Anything that can cause a change (mutation) in the genetic material of a living cell.

Mutagen

The deposit and/or absorption of residual radioactive material or biological or chemical agents on or by structures, areas, personnel, or objects.

NBC Contamination

The capability of a system (and its crew) to withstand a nuclear, biological, and chemical contaminated environment and relevant decontamination without losing the ability to accomplish the assigned mission. A nuclear, biological, and chemical contamination survivable system is hardened against nuclear, biological, and chemical contamination and decontaminants; it can be decontaminated, and is compatible with individual protective equipment.

**NBC Contamination
Survivability**

GLOSSARY OF TERMS

Nerve Agent

Organic esters of phosphoric acid used as a chemical warfare agent because of their extreme toxicity (Tabun-GA, Sarin-GB, Soman-CD, CF, and VX). All are potent inhibitors of the enzyme, acetylcholinesterase, which is responsible for the degradation of the neurotransmitter, acetylcholine. Symptoms result from excess accumulation of acetylcholine in neuronal synapses or myoneural junctions. Nerve agents are readily absorbed by inhalation and/or through intact skin.

NOAEL (No Observed Adverse Effects Level)

An exposure level at which there are no statistically or biologically significant increases in the frequency or severity of adverse effects (to tissue, cells, organs, etc.) between the exposed population and its appropriate control (some effects may be produced at this level, but they are not considered as adverse, nor precursors to specific adverse effects). Based on the highest exposure without adverse effect.

NOEL (No Observed Effects Level)

An exposure level at which there are no statistically or biologically significant increases in the frequency or severity of *any* effect (to tissue, cells, organs, etc.) between the exposed population and its appropriate control.

Noise

Any unwanted sound.

Nondevelopmental Item (NDI)

Those items determined by a Materiel Acquisition Decision Process (MADP) Review (i.e., DSARC, ASARC, or IPR, as appropriate) to be available for acquisition to satisfy an approved materiel requirement with no expenditure of Army research, development, test, and evaluation (RDTE) funds for development, modification, or improvement. The item may be a commercial product or an item that has been developed and used by another service, country, or government agency.

Nonionizing Radiation

Emissions from the electromagnetic spectrum that have insufficient energy to produce ionization of molecules. This includes ultraviolet, visible, infrared, microwave, and laser radiation.

GLOSSARY OF TERMS

The capability of a system to withstand initial nuclear weapon effects and still accomplish its mission. These effects include blast, initial nuclear radiation, thermal pulse, and electromagnetic pulse.

Nuclear Survivability

The basic principals for controlling the occupational environment are substitution, isolation, and ventilation.

Occupational Environment Controls

The ORD is a formatted statement containing performance (operational effectiveness and suitability) and related operational parameters for the proposed concept or system. It establishes objectives and minimum acceptable requirements for those performance capability parameters necessary to characterize the proposed system concept. It is the bridge connecting the Mission Need Statement (MNS) to the acquisition program baseline and the specifications for the concept or system.

Operational Requirements Document (ORD)

Testing and evaluation of materiel systems accomplished with typical user operators, crews, or units in as realistic an operational environment as possible to provide data for estimating:

- The military utility, operational effectiveness, and operational suitability (including compatibility, interoperability, reliability, availability, maintainability, supportability, operational man (soldier) machine interface, and training requirements) of new systems.
 - From the user viewpoint, the system's desirability considering systems already available and the operational benefits and/or burdens associated with the new system.
 - The need for modification to the system.
 - The adequacy of doctrine, organization, operating techniques, tactics, and training for employment of the system, and, when appropriate, its performance in a countermeasures environment.
-

Operational Testing (OT)

Decrease in atmospheric oxygen concentrations below that which is commonly found in air (21 percent by volume). Large reductions in oxygen concentrations can cause shortness of breath, impaired

Oxygen Deficiency

GLOSSARY OF TERMS

coordination, and judgment with progression to unconsciousness and death.

Parameter

The property or quantity that measurements are expected to evaluate.

Parent

A radioactive nucleus that disintegrates to form a radioactive product or daughter.

Expressed in three forms:

Inhalable Particulate Mass TLVs (IPM-TLVs) for those materials that are hazardous when deposited anywhere in the respiratory tract. Particles with aerodynamic diameters up to 100 micrometers are of interest.

Particle Size-Selective TLVs (PSS-TLVs)

Thoracic Particulate Mass TLVs (TPM-TLVs) for those materials that are hazardous when deposited anywhere within the lung airways and the gas exchange region. Particles with aerodynamic diameters up to 25 micrometers are of interest.

Respirable Particulate Mass TLVs (RPM-TLVs) for those materials that are hazardous when deposited in the gas exchange region. Particles with aerodynamic diameters up to 10 micrometers are of interest.

Particulate

A particle of solid or liquid matter. Particle aerodynamic diameters of biological interest range up to 100 micrometers.

Pathogen

Any microorganism capable of causing disease.

Pathological Waste

Any waste that includes anatomical parts of humans and animals, excluding corpses and animal carcasses.

Percutaneous Exposure

The absorption of a contaminant through the unbroken skin.

GLOSSARY OF TERMS

Employees' permitted exposure to any material listed in Table Z-1, Z-2, or Z-3 of OSHA standard 1910.1000, Air Contaminants. It is enforced as a legal standard.

**Permissible Exposure Limit
(PEL)**

Military and civilian persons of the abilities, skill level, and grades required to operate, maintain, and support a system in peacetime and war. Personnel refers to the consideration of the ability of the Army to provide qualified people in terms of specific aptitudes, experience, and other human characteristics needed to use, operate, maintain, and support Army systems or items. It requires detailed assessment of the aptitudes that soldiers must possess in order to complete training and use, operate, and/or maintain the system successfully. Iterative analyses must be accomplished as integral components of the new system design process, comparing projected quantities of qualified personnel with requirements of the new system, any system(s) being replaced, overall Army needs for similarly qualified people, and priorities established by the Department of the Army. As necessary, the system is configured specifically to accommodate the probable capabilities of personnel projected to be available so that the new system is supportable from a personnel standpoint. Analysis of specific system personnel requirements using human factors engineering is necessary for each system design option considered, using "best available" information early in the acquisition process and improved information as the system design becomes more mature. Personnel analyses must consider not only simple availability, but also the capability of the Army personnel management system to provide the needed numbers of properly qualified people at a reasonable cost. Personnel must be included in system life cycle cost estimates and system design tradeoffs between machine costs versus personnel costs. Personnel analyses and projections are needed in time to allow orderly recruitment, training, and assignment of personnel with equipment fielding.

Personnel

An integrated system for the establishment, maintenance, and revision of the Future Years Defense Plan (FYDP) and the DOD budget.

**Planning, Programming,
Budgeting, and Execution
System (PPBES)**

GLOSSARY OF TERMS

Pollution Prevention (P2)	The elimination or minimization of hazardous materials through source reduction using methods such as substitution, process change, etc., so that occupational and environmental health effects from hazardous waste or environmental contamination are controlled.
Population	Refers to a group of items/persons/animals belonging to a well-defined class from which items/persons/animals are taken for measurement.
ppm	Parts per million; the number of parts of a given contaminant in a million parts of air.
Precision	Refers to the agreement among repeated measurements of the same quantity.
Preliminary Hazard Analysis (PHA)	As implied by the title, PHA is the initial effort in hazard analysis during the system design phase or the programming and requirements development phase for facilities acquisition. It may also be used on an operational system for the initial examination of the state of safety. The purpose of the PHA is not to affect control of all risks, but to fully recognize the hazardous states with all of the accompanying system applications.
Preliminary Hazards List (PHL)	The PHL provides to the materiel developer a list of hazards that may require special safety design emphasis or hazardous areas where in-depth analyses need to be done. The MATDEV may use the results of the PHL to determine the scope of follow-on hazard analyses.
Pre-planned Product Improvements (P³I)	Planned future evolutionary improvement of developmental systems for which design considerations are effected during development to enhance future application of projected technology. Includes improvements planned for ongoing systems that go beyond the current performance envelope to achieve a needed operational capability.

GLOSSARY OF TERMS

The total number of cases of a disease in existence in a population at a certain time in a designated area.

Prevalence

A program to incorporate a configuration change involving engineering and testing effort on major end items and depot-repairable components or changes on other than developmental items to increase system/combat effectiveness or extend the useful military life. A reconfiguration of an end item of Army or multiservice materiel-type classified standard that is funded, managed, and completed as a single project. The term "PIP" is applied to the project from its start as a proposal through its completion. A PIP is initially constituted in the form of a PIP package and its status is periodically reported on Product Improvement Information Reports (PRIMIR).

**Product Improvement
Program (PIP)/Product
Improvement Proposal**

A document submitted to the Office of the Secretary of Defense (SECDEF) by the heads of the DOD components that recommends the total resource requirements within the parameters of the SECDEF fiscal guidance.

**Program Objective
Memorandum (POM)**

The PO&ILCCE are two statutorily-required cost estimates. The PO&ILCCE are briefed to the Secretary of Defense Cost Analysis Improvement Group (CAIG) before each milestone, beginning with Milestone I.

**Program Office and
Independent Life Cycle
Cost Estimate (PO&ILCCE)**

Generic term for the actual manager of the program at its basic level; i.e., the program manager (PM) MDAP, ADAP, and level I nonmajor programs and the project officer or equivalent for level II and III nonmajor programs.

Program Sponsor

Characteristics by which a substance may be identified. Physical properties describe its state of matter, color, odor, and density; chemical properties describe its behavior in reaction with other materials.

Properties

With personal protective equipment it is the ratio of the concentration outside the protective equipment to the concentration inside the

Protection Factor

GLOSSARY OF TERMS

protective equipment. Measurement sites are critical for proper determination (e.g., for a protective mask, the measurements inside the mask would be made at the subject's breathing zone, and the measurements outside the mask would be made in a corresponding zone).

Prototype

A model suitable for evaluation of design, performance, and production potential.

Radiation

Transfer of energy through space or a material medium by electromagnetic waves or particles.

Radiation Energy

Energy created by either ionizing or nonionizing radiation.

Radiofrequency Radiation

Electromagnetic spectrum of biological interest with frequencies of 30 kilohertz to 300 megahertz. The primary effect is thermal in nature. However, there may be potential nonthermal effects.

Range

The difference between the largest and smallest values in a collection of measurements.

Reference Concentration (RfC)

An estimate (with uncertainty spanning perhaps an order of magnitude) of a daily inhalation exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effects during a lifetime.

Reference Dose (RfD)

An estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effects during a lifetime.

Regulated Medical Waste

Waste that is potentially capable of causing disease and may pose a risk to both individual and community health if not handled or treated properly. Regulated medical wastes include any discarded cultures stocks and vaccines, pathological wastes, blood and blood products, used and unused sharps, animal wastes, or isolation CDC risk group IV wastes.

GLOSSARY OF TERMS

The ratio of incidence or risk among exposed individuals to incidence or risk among nonexposed individuals.

Relative Risk (sometimes referred to as Risk Ratio)

A fundamental characteristic of materiel expressed as the probability that an item will perform its intended function for a specified interval under stated conditions. Durability is a special case of reliability.

Reliability

RAM requirements are those imposed on materiel systems to ensure they are operationally ready for use when needed, will successfully perform assigned functions, and can be economically operated and maintained within the scope of logistics concepts and policies. RAM programs are applicable to materiel systems, test measurement and diagnostic equipment (TMDE), training devices, and facilities developed, produced, maintained, procured, or modified for Army use. Reliability is the duration of probability of failure-free performance under stated conditions. Availability is a measure of the degree to which an item is in an operable and committable state at the start of the mission. Maintainability is the ability of an item to be retained in or restored to specified conditions within a given time when maintenance is performed by personnel having specified skill levels, using prescribed procedures and resources, at each prescribed level of maintenance and repair.

Reliability, Availability, and Maintainability (RAM)

Request for the manufacturer to submit a proposal supported by cost breakdown. It provides a description of the items to be procured. It may include specifications, quantities, time and place of delivery, method of shipment, packaging and instruction manual requirements, materiel to be furnished, and data requirements, both support and administrative.

Request for Proposal

Documents establishing the need for a materiel acquisition program, how the materiel will be employed, and what the materiel must be capable of doing. The three requirements documents are:

Requirements Documents

Mission Need Statement (MNS). Nonsystem-specific statement of operational capability need. This document can initiate a materiel acquisition program.

GLOSSARY OF TERMS

Operational Requirements Document (ORD). States the performance and related operational parameters of a proposed concept or system. It is developed during Phase 0 and defines system capabilities needed to satisfy the MNS. It also includes Human System Integration constraints and environmental conditions that may affect the system.

System Threat Assessment Report (STAR). Document prepared to Milestone 1 that documents the services threat assessment at system level. It is for ACAT I programs. Similar type documents are prepared for ACAT II, III, and IV programs.

Residual Hazards

Hazards that are not eliminated by design.

Residual Risk

The probability or likelihood of injury resulting from the actual use of a substance in the quantity and manner proposed once all recommendations to eliminate or minimize the hazard have been implemented.

Retrofit

The application of measures or controls to correct deficiencies in fielded systems.

**Reversible versus
Irreversible Toxicity**

Reversible toxic effects are those that can be repaired, usually by a specific tissue's ability to regenerate or mend itself after chemical exposure, while irreversible toxic effects are those that cannot be repaired.

Risk

Probability or likelihood of an adverse effect or event (e.g., injury, disease, or death) resulting from the actual use of a substance in the quantity and manner proposed. It is the *product* of (1) the probability that an adverse effect or event will occur under specific circumstances of exposure *and* (2) the probability that those specific circumstances of exposure will be realized. In quantitative terms, risk is expressed in values ranging from zero (representing the certainty that harm will not occur) to one (representing the certainty that harm will occur).

GLOSSARY OF TERMS

Scientific process of evaluating the toxic properties of a chemical and the conditions of human exposure to it in order both to ascertain the likelihood that exposed humans will be adversely affected, and to characterize the nature of the effects they may experience. May contain some or all of the following four steps:

Hazard Identification—The determination of whether a particular chemical is or is not causally linked to particular health effect(s).

Risk Assessment

Dose-Response Assessment—The determination of the relation between the magnitude of exposure and the probability of occurrence of the health effects in question.

Exposure Assessment—The determination of the extent of human exposure.

Risk Characterization—Description of the nature and often the magnitude of human risk, including attendant uncertainty.

A code that is used to quantify risk to personnel operating or maintaining the system or conducting an operation. The RACs show the adverse health effect or possible loss of bodily systems described in categories of hazard severity and hazard probability. The RAC is assigned based on the failure to implement the recommendations for eliminating or minimizing the hazard.

**Risk Assessment Code
(RAC)**

A decision-making process that entails consideration of political, social, economic, and engineering information with risk assessment information to develop, analyze, and compare regulatory options and to select the appropriate regulatory response to a potential health risk.

Risk Management

Reciprocal of risk. It is the probability that harm will not occur under specified conditions.

Safety

A formal summary of the safety data collected during the design and development of the system. In the SAR, the materiel developer

**Safety Assessment Report
(SAR)**

GLOSSARY OF TERMS

summarizes the hazard potential of the item, provides a risk assessment, and recommends procedures or other corrective actions to reduce these hazards to an acceptable level.

Safety Factor

Term formerly applied to the concept of uncertainty. See Uncertainty Factor (UF).

Sample Data Collection (SDC)

A method for obtaining information on the performance and maintainability of an item of equipment. Data are obtained directly from observations made in the field. An effort is made to see that the sample from which the feedback is obtained is representative of the total population.

Sanitize

To reduce the microbial flora in or on articles, such as eating utensils, to levels judged safe by public health authorities.

Segmental Vibration

Vibration in which the part of the individual's body (e.g., hand or hands) is subjected to mechanical vibration, while the bulk of the body rests on a stationary surface.

Severity

The degree to which an effect changes and impairs the functional capacity of an organ system.

Shock

Delivery of a mechanical impulse or impact to an individual transmitted from the acceleration or deceleration of a medium with which an individual has contact.

Short-Term Exposure

Multiple or continuous exposures occurring over a week or so.

Short-Term Public Emergency Guidance Level (SPEGL)

A suitable concentration of a substance in air (as a gas, vapor, or aerosol) for unpredicted, single, short-term, emergency exposure of the general public.

Smoke

Solid or liquid particles 0.3 to 0.5 micron in diameter.

Soldier

The term "soldier" refers to human beings, military and/or civilians.

Soldier/Machine Interface

Consideration through system analysis and psychophysiology of equipment design and operational concepts to ensure they are

GLOSSARY OF TERMS

compatible with the capabilities and limitations of operators and maintenance personnel. Also referred to as soldier-materiel interaction and man-machine interface.

Soldier survivability is that characteristic of soldiers that enables them to withstand (or avoid) adverse military action (both friend and foe) or the effects of natural phenomena that would result in the loss of capability to continue effective performance of the prescribed mission. System design considerations for soldier survivability are a combination of, but not limited to, those system characteristics that:

- Reduce fratricide
- Reduce detectability of the soldier
- Prevent attack on the soldier, if detected
- Prevent bodily damage, if attacked
- Minimize medical injury, if wounded
- Reduce physical and mental fatigue

Soldier Survivability

A report prepared to reflect the system's effects in regards to antifratricide and soldier survivability. Data from this report is input to the MANPRINT Integration Report.

**Soldier Survivability
Domain Report**

Discarded material (solid, liquid, semisolid, or contained gaseous) resulting from industrial, commercial, mining, or agricultural operations or community activities.

Solid Waste

The process wherein the requirements, facts, recommendations, and government policy relevant to an award decision in a competitive procurement of a system/project are examined and the decision made.

**Source Selection
Evaluation (SSE)/Source
Selection Process**

The sensation produced through the organs of hearing, usually by vibrations transmitted in a material medium, commonly air.

Sound

A group composed of representatives of HQDA, CBTDEV, operational tester, MATDEV, logistician, trainer, and PM designee, that

Special Study Group (SSG)

GLOSSARY OF TERMS

convenes during the Requirements/Technology Base Activity phase to conduct analysis, ensures inclusion of all alternatives within an analysis, monitors experimentation, or undertakes other such tasks that may require concentration of special expertise for a short duration. Normally chaired by a CBTDEV representative. MATDEV representative on the SSG develops the Acquisition Strategy (AS).

Special Task Force (STF)

A group that is normally composed of the chartered task force director and representatives of the user, materiel developer, trainer, combat developer, HQDA, operational tester, and the project manager designee. This task force conducts an in-depth investigation of the need for the system described in the requirements documents and of any necessary alternative system designs, monitors experimentation, and arrives at a recommended approach to provide the system described in an approved ORD.

Standard Air

Air at 70 degrees Fahrenheit, 29.92 inches mercury, weighing 0.075 pounds per cubic foot.

Subchronic Exposure

Multiple or continuous exposures occurring usually over three months.

Supportability

That characteristic of materiel indicative of its ability to be sustained at a required readiness level when supported in accordance with specified concepts and procedures.

Survivability

The capability of a system to avoid or withstand man-made hostile environments without suffering an abortive impairment of its ability to accomplish its designated mission.

Symptom

Any bit of evidence from an individual indicating illness.

System

A composite, at any level of complexity, of personnel, procedures, materials, tools, equipment, facilities, and software. The elements of this composite entity are used together in the intended operational or support environment to perform a given task or achieve a specific production, support, or mission requirement.

GLOSSARY OF TERMS

Spread throughout the body, affecting all body systems and organs, not localized in one spot or area.

Systemic

Effects that require absorption and distribution of the toxicant to a site distant from its portal of entry, at which point effects are produced. Most chemicals that produce systemic toxicity do not cause a similar degree of toxicity in all organs, but usually demonstrate major toxicity to one or two organs. These are referred to as target organs of toxicity for that chemical.

Systemic Effects

See Systemic Effects.

Systemic Toxicity

The SMMP is the Army's Human Systems Integration Plan (HSIP). It is a planning and management tool that outlines and documents the human systems integration (HSI) management approach, associated decisions and planning efforts, user concerns, and resolution of HSI (MANPRINT) issues during system development and acquisition process. Identification and documentation of these issues early in the system acquisition process increases the probability of their resolution, thereby enhancing total system performance, affordability, supportability, and conservation of the Army resources.

**System MANPRINT
Management Plan (SMMP)**

The SSDR is one of the seven domain reports prepared under the MANPRINT program. The purpose of the report is to assess the overall safety of the emerging or changing systems and ensure the system safety issues and concerns are identified, and the recommended solutions, are integrated into the MANPRINT program. Data from this report is input into the MANPRINT Integration Report.

**System Safety Domain
Report (SSDR)**

The application of system safety management and engineering principles throughout a system's life cycle.

System Safety Engineering

A description of the planned methods to be used by the contractor to implement the tailored requirements of MIL-STD 882B, including organizational responsibilities, resources, methods of accomplishment, milestones, depth of effort, and integration with other

**System Safety Program
Plan**

GLOSSARY OF TERMS

program engineering and management activities and related systems.

Table of Distribution and Allowances (TDA)

A requirements/authorization document that prescribes the organizational structure, personnel and equipment authorizations, and requirements of a military unit to perform a specific mission for which there is no appropriate TOE.

Table of Organization and Equipment (TOE)

A table that prescribes the normal wartime mission, organizational structure, and personnel and equipment requirements for a military unit, and is the basis for an authorization document, the MTOE. The TOE is not an authorization document.

Target Audience Description (TAD)

The TAD lists the occupational identifiers for personnel who are projected to operate, maintain, repair, train, and support a specific future Army system. Further, for each identifier, the TAD states the quantities needed and provides an information source that will describe the characteristics of the personnel identified. Describing projected system personnel early in the acquisition process increases the Army's flexibility to achieve the best system solution in terms of design, affordability, supportability, and performance.

Target Organ of Toxicity

See Systemic Effects.

Task Analysis

A process of reviewing actual job content and context to classify information into units of work within a job. The process provides a procedure for isolating each unique unit of work, provides a procedure for describing each unit accomplished, and provides descriptive information to assist in the design and testing of training products.

TD₅₀ (Toxic Dose)

Dose of a substance needed to produce a defined toxic effect in 50 percent of the exposed population. Infrequently used term, it is equivalent to ED₅₀ where "toxicity" is the measured "effect."

Technology Base

The Army's science and technology base consisting of basic research, exploratory development, and advanced development.

GLOSSARY OF TERMS

Environmental conditions that will cause adverse effects on individuals. These conditions may cause heat illness or cold injury.

Temperature Extremes

The hearing loss suffered as the result of noise exposure, all or part of which is recovered during an arbitrary period of time when one is removed from the noise.

Temporary Threshold Shift (TTS)

An agent or substance that may cause physical defects in the developing embryo or fetus when a pregnant female is exposed to that substance.

Teratogen

Basic planning document for all life cycle test and evaluation (T&E) related to a particular acquisition system. The TEMP documents the overall structure and objectives of the test and evaluation program. It identifies necessary developmental test and evaluation and operational test and evaluation activities. It relates test objectives to required system characteristics and critical issues and integrates objectives, responsibilities, resources, and schedules for all T&E to be accomplished.

Test and Evaluation Master Plan (TEMP)

A formally chartered organization chaired by the materiel developer and having as a minimum membership representatives (with authority to act for their respective commands/activities) from the combat developer, the logistician, the operational tester, the materiel developer, and, when appropriate, the contractor. The primary purpose of the TIWG is to provide a forum for direct communication to facilitate the integration of test requirements and speed up the TEMP coordination process. The objective of the TIWG is to reduce costs by integrating testing to the maximum extent, eliminate redundant testing, and facilitate the coordination of test planning, interchange of test data, and use of test resources to achieve cost-effective testing.

Test Integration Working Group (TIWG)

The dose or exposure below which an adverse effect is not expected.

Threshold

GLOSSARY OF TERMS

Threshold Dose

The smallest amount of a toxic substance that can produce the first recognizable injuries (e.g., irritation of skin, eyes, or nose; miosis).

Threshold Limit Value Categories

Threshold Limit Value-Time-Weighted Average (TLV-TWA)—The time-weighted average concentration for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.

Threshold Limit Value-Short-Term Exposure Limit (TLV-STEL)—The concentration to which workers can be exposed continuously for a short period of time without suffering from (1) irritation, (2) chronic or irreversible tissue damage, or (3) narcosis of sufficient degree to increase the likelihood of accidental injury, impair self-rescue, or materially reduce work efficiency, and provided that the daily TLV-TWA is not exceeded. It is not a separate independent exposure limit; rather, it supplements the time-weighted average (TWA) limit where there are recognized acute effects from a substance whose toxic effects are primarily of a chronic nature. Exposures up to the STEL should not be longer than 15 minutes and should not occur more than four times per day.

Threshold Limit Value-Ceiling (TLV-C)—The concentration that should not be exceeded during any part of the working exposure.

Time-weighted Average Concentration

Concentrations of contaminants that have been weighted for the time duration of the sample. A sufficient number of samples are needed to determine a time-weighted average concentration throughout a complete cycle of operations or through the work shift.

Time-weighted Average Exposure

An average over a given (working) period of an individual's exposure, as determined by sampling at given times during the period.

TLV, Threshold Limit Value

Refers to airborne concentrations of substances and represents conditions under which it is believed nearly all workers may be repeatedly exposed to day after day, without adverse health effects. A table of these values and accompanying precautions is published

GLOSSARY OF TERMS

annually by the American Conference of Governmental Industrial Hygienists (ACGIH).

A system is a composite of people, procedures, materials, tools, equipment, and software that provides an operational capability to perform a stated mission (in the case of a weapon system) or a particular function or set of functions (in the case of an AIS). A total system includes the manpower (the number of civilian and military personnel required for its operation, maintenance, and support), the personnel (aptitudes, capabilities, and limitations of the designated operators, maintainers, and support personnel), the affordable school and unit training necessary to ensure that those personnel can achieve the system performance requirements, and the required support equipment and doctrine.

Total System

The performance of the system defined above is customarily measured in two relatively independent areas: effectiveness (how *well* it works when it does work) and availability (how *often* it works). Both areas are heavily dependent upon human performance, but usually from different personnel: effectiveness is largely influenced by operator behavior (based on aptitudes and training), while availability is influenced by the behavior (often based on different aptitudes and different training) of maintenance and support personnel. Different measures of performance are used in the test and evaluation of operations and maintenance, and both sets should be clearly stated in the SMMP.

Total System Performance

Capacity of a substance to induce injury. It describes the nature, degree, and extent of undesirable effects.

Toxicity

Quantal Data—Specifies the number of animals affected as a function of dose rate (e.g., mg/kg/day) for a single type of effect. The numbers of animals with tumors or that die from a chemical exposure are examples. Quantal data are often reported as an incidence (percent response) and, thus, can be used to construct a dose-response curve.

Toxicity Data (types of)

GLOSSARY OF TERMS

Continuous Data—Represents the change in some measured value of a biological indicator (e.g., organ weights, triglyceride levels in the liver, and serum enzyme measurements) as a function of dose rate. Continuous data can be used to construct a dose-effect curve.

Toxicity Data (types of)
continued

Graded Data—Specifies the form or severity of adverse effects as a function of dose rate without reference to the number of animals affected or to a continuous measure of one parameter. Graded data often are presented as categories (liver necrosis, lung lesions) or as judgments of severity. Fatty infiltration of the liver, single-cell liver necrosis, and liver necrosis are examples of sequence of severity judgments. Graded data can be used to construct a dose-severity curve.

Additive—Situation in which the combined effect of two chemicals is equal to the sum of the effect of each agent given alone (e.g., $2+3=5$).

Toxicological Effects

Synergistic—Situation in which the combined effect of two chemicals is much greater than the sum of the effect of each agent given alone (e.g., $2+3=20$).

Potentiation—Situation in which one substance does not have a toxic effect, but when added to another chemical it makes the latter much more toxic (e.g., $0+3=10$).

Antagonism—Situation in which two chemicals given together, interfere with each other's actions or one interferes with the action of the other chemical (e.g., $4+6=8$, $4+0=1$, $4+4=0$).

Toxic—Poisonous

Effects may range from mild to lethal depending on the dose and resistance of the individual.

Trade-off Analysis (TOA)

A document prepared by an STF or SSG, or jointly by the combat and materiel developers, to determine which technical approach offered in the Trade-off Determination (TOD) is best.

GLOSSARY OF TERMS

The document prepared by the materiel developer. It is sent to the combat developer or to an STF or SSG to convey the feasibility of a potential system. Included are technical risks related to each approach, estimated RDTE, and procurement costs and schedules.

**Trade-off Determination
(TOD)**

Consideration of the training necessary and time required to impart the requisite knowledge, skills, and abilities to qualify Army personnel for use, operation, maintenance, and support of Army systems or items. It involves (1) the formulation and selection of engineering design alternatives that are supportable from a training perspective, (2) the documentation of training strategies, and (3) the timely determination of resource requirements to enable the Army training system to support system fielding. Human factors engineering techniques are used to determine the tasks that must be performed by system user, operator, maintenance, and support personnel; the conditions under which they must be performed; and the performance standards which must be met. Training is linked with personnel analyses and actions in that availability of qualified personnel is a direct function of the training process. As a minimum, the following must be considered:

Training

- Training effort and costs versus system design
- Training times
- Training program development, considering aptitudes of available personnel
- Sustainment training, as distinguished from training associated with initial system fielding
- Developmental training, as distinguished from Initial Entry Training
- Training device design, development, and use
- Training base resourcing manpower and personnel implications
- New Equipment Training (NET)
- Formal training base instruction versus on-the-job training (OJT) in units
- Unit training

GLOSSARY OF TERMS

- Operational testing of the adequacy of training programs and techniques

Training Device (TD)

Any three-dimensional object developed, fabricated, or procured specifically for improving the learning process. Training devices may be either system devices or nonsystem devices. System devices are designed for use with one system or item of equipment, including subassemblies and components. Nonsystem devices are designed to support general military training and/or for use with more than one system or item of equipment, including subassemblies and components.

Trauma

Physical injury that may occur because of sharp or blunt object impact with the eyes or body surface.

Tumor

A swelling or enlargement due to pathogenic overgrowth of tissue.

TWA, Time-weighted Average Concentration

Concentrations of airborne contaminants that have been weighted for a certain time duration, usually 8 hours.

Type Classification (TC)

Identifies the life cycle status of a materiel system by the assignment of a type classification designation after a production decision by the appropriate authority, and records the status of a materiel system in relation to its overall life history as a guide to procurement, authorization, support, asset, and readiness reporting.

ug

Microgram(s).

Ultraviolet Radiation

Those wavelengths of biological interest in the spectral region of 100 to 400 nanometers. The eyes and skin are the critical organs of interest. Ultraviolet radiation may be emitted from electrical arcs, gas and vapor discharges, fluorescent and incandescent sources, and solar radiation.

um

Micrometer(s).

GLOSSARY OF TERMS

One of several, generally 10-fold, factors used in operationally deriving a Standard or a Reference Dose (RfD) from experimental data. UFs are intended to account for (1) the variation in sensitivity among the members of the human population; (2) the uncertainty in extrapolating animal data to the case of humans; (3) the uncertainty in extrapolating from data obtained in a study that is less-than-lifetime exposure; (4) the uncertainty in using LOAEL data rather than NOAEL data; and (5) the inability of any single study to address adequately all possible adverse outcomes in man.

Uncertainty Factor (UF)

The gaseous form of substances that are normally in the solid or liquid state and that can be changed to these states by increasing the pressure or decreasing the temperature. Vapors diffuse.

Vapor

Change of a substance from a liquid into a gas.

Vaporization

One of the principal methods to control health hazards, may be defined as "causing fresh air to circulate to replace foul air simultaneously removed."

Ventilation

Airflow designed to dilute contaminants to acceptable levels.

Ventilation, Dilution

Air movement caused by a fan or other air moving device.

Ventilation, Mechanical

Air movement caused by wind, temperature difference, or other nonmechanical factors.

Ventilation, Natural

An oscillation motion about an equilibrium position produced by a disturbing force.

Vibration

Those wavelengths of biological interest in the spectral region of 380 to 780 nanometers. The critical organ is the eye.

Visible Radiation

Electrical networks (A,B,C) associated with sound level meters. The C network provides a flat response over the frequency range 20-10,000 Hertz of interest while the A and B networks selectively discriminate against low (less than 1000 hertz) frequencies.

Weighting Network (sound)

GLOSSARY OF TERMS

Whole-body Vibration

Vibration in which the individual's whole body is subjected to mechanical vibration.

GLOSSARY OF TERMS

GLOSSARY OF TERMS



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